Cavanaugh Macdonald
CONSULTING, LLC
The experience and dedication you deserve

Teachers' Retirement System
State of Montana

Actuarial Valuation
As of July 1, 2019

www.CavMacConsulting.com

Cavanaugh Macdonald
CONSULTING, LLC
The experience and dedication you deserve

October 11, 2019

Teachers' Retirement Board
State of Montana
P.O. Box 200139
Helena, MT 59620-0139

Members of the Board:

In this report are submitted the results of the annual valuation of the assets and liabilities of the Teachers' Retirement System of Montana (TRS), prepared as of July 1, 2019.

The purpose of this report is to provide a summary of the funded status of the System as of July 1, 2019. While not verifying the data at source, the actuary performed tests for consistency and reasonability. The valuation indicates that the statutory contribution rate reflecting all anticipated contribution increases are sufficient to amortize the unfunded accrued liability within a 29 year period.

The promised benefits of the System are included in the actuarially calculated contribution rates which are developed using the Entry Age Normal cost method. Four-year market related value of assets is used for actuarial valuation purposes. Gains and losses are reflected in the unfunded accrued liability that is being amortized by regular annual contributions as a level percentage of payroll, on the assumption that payroll will increase by 3.25% annually. The assumptions recommended by the actuary and adopted by the Board are in the aggregate reasonably related to the experience under the Fund and to reasonable expectations of anticipated experience under the Fund.

This is to certify that Todd Green, President for Cavanaugh Macdonald Consulting is a member of the American Academy of Actuaries and meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein. This also certifies that the undersigned has experience in performing valuations for public retirement systems, that the valuation was prepared in accordance with principles of practice prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures, based on the current provisions of the retirement system and on actuarial assumptions that are internally consistent and reasonably based on the actual experience of the System.

Future actuarial results may differ significantly from the current results presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the plan's funded status); and changes in plan provisions or applicable law. Since the potential impact of such factors is outside the scope of a normal annual actuarial valuation, an analysis of the range of results is not presented herein.

The Table of Contents, which immediately follows, outlines the material contained in the report.

Respectfully submitted,

Todd B. Green, ASA, FCA, MAAA
President

TBG/jnw

Teachers' Retirement System
State of Montana

Table of Contents

	Page
Section 1 Summary of Findings	**1**
Section 2 Assets	**12**
Table 1 Statement of Fiduciary Net Assets	13
Table 2 Statement of Changes in Fiduciary Net Assets	14
Table 3 Determination of Actuarial Value of Assets	15
Table 4 Historical Investment Returns	16
Table 5 Historical Investment Returns, cont	17
Table 6 Market Value of Assets vs. Actuarial Value of Assets	18
Section 3 Actuarial Present Value of Future Benefits	**19**
Table 7 Actuarial Present Value of Future Benefits for Contributing Members, Former Contributing Members, and Beneficiaries	20
Section 4 Employer Contributions	**21**
Table 8 Normal Cost Contribution Rates As Percentages of Salary	23
Table 9 Unfunded Actuarial Accrued Liability	24
Section 5 Cash Flows	**25**
Table 10 Cash Flow History	26
Table 11 Cash Flow Projection Statutory Basis	27
Section 6 Actuarial Gains or Losses	**28**
Table 12 Analysis of Actuarial Gains or Losses	29
Table 13 Historical Actuarial Gains or Losses	30
Section 7 Risk Considerations	**31**
Appendix A Actuarial Procedures and Assumptions	**36**
Appendix B Summary of Benefit Provisions	**47**
Appendix C Valuation Data	**52**
Appendix D Comparative Schedules	**61**
Appendix E Glossary	**66**

Section I

Summary of Findings

For convenience of reference, the principal results of the valuation and a comparison with the preceding year's results are summarized below:

(Dollar amounts in thousands)

VALUATION DATE	**July 1, 2019**	**July 1, 2018**
Active members		
Number		
Full-Time Members	13,196	13,027
Part-Time Members	6,490	6,240
Annual valuation compensation	$ 857,468	$ 829,709
Retired members and beneficiaries		
Number	16,256	15,933
Annual allowances	$ 383,495	$ 367,990
Inactive Members		
Vested Terminated Members	1,791	1,772
Non-Vested Terminated Members	14,261	13,967
Assets		
Actuarial value	$ 4,219,515	$ 4,094,393
Market value	4,220,286	4,148,324
Actuarial Accrued Liability (AAL)	$ 6,148,556	$ 6,004,434
Unfunded Actuarial Accrued Liability	$ 1,929,041	$ 1,910,042
Funded Ratio	68.63%	68.19%
Market Value Rate of Return	5.69%	8.82%
Annual Cost		
Total Normal Rate	9.78%	9.96%
Employee Contribution Rate	8.15%	8.15%
Employer Normal Rate	1.63%	1.81%
Employer Statutory Contribution Rate		
Normal Rate	1.63%	1.81%
Administrative Expense Load	0.36%	0.36%
UAAL Rate	9.57%	9.29%
Total Rate	11.56%	11.46%
Amortization Period*	29 Years	31 Years

* Reflects anticipated increases in employer contribution rates.

As a result of this actuarial valuation of the benefits in effect under the Montana Teachers' Retirement System as of July 1, 2019, the statutory employer contributions are sufficient to amortize the Unfunded Actuarial Accrued Liability (UAAL) of the Retirement System within 29 years. The Funded Ratio is 68.63%.

The table below shows a history of the legislated contribution rates as a percent of pay. In addition to these contributions the State will contribute $25 million annually to the System payable July 1st of each year.

Finally, MCA 19-20-605 requires each employer to contribute 9.85% of total compensation paid to all re-employed TRS retirees employed in a TRS reportable position. Pursuant to MCA 19-20-609, this amount shall increase by 1.00% for fiscal year 2014 and increase by 0.10% each fiscal year through 2024 until the total employer contribution is equal to 11.85% of re-employed retiree compensation.

History of Legislated Contributions
(as a Percent of Pay)

School District and Other Employers

	Members	Employers	General fund	Total employee & employer
Prior to July 1, 2007	7.15%	7.47%	0.11%	14.73%
July 1, 2007 to June 30, 2009	7.15%	7.47%	2.11%	16.73%
July 1, 2009 to June 30, 2013	7.15%	7.47%	2.49%	17.11%
July 1, 2013 to June 30, 2014	8.15%	8.47%	2.49%	19.11%
July 1, 2014 to June 30, 2015	8.15%	8.57%	2.49%	19.21%
July 1, 2015 to June 30, 2016	8.15%	8.67%	2.49%	19.31%
July 1, 2016 to June 30, 2017	8.15%	8.77%	2.49%	19.41%
July 1, 2017 to June 30, 2018	8.15%	8.87%	2.49%	19.51%
July 1, 2018 to June 30, 2019	8.15%	8.97%	2.49%	19.61%
July 1, 2019 to June 30, 2020	8.15%	9.07%	2.49%	19.71%
July 1, 2020 to June 30, 2021	8.15%	9.17%	2.49%	19.81%
July 1, 2021 to June 30, 2022	8.15%	9.27%	2.49%	19.91%
July 1, 2022 to June 30, 2023	8.15%	9.37%	2.49%	20.01%
July 1, 2023 to June 30, 2024	8.15%	9.47%	2.49%	20.11%

State and University Employers

	Members	Employers	General fund	Total employee & employer
Prior to July 1, 2007	7.15%	7.47%	0.11%	14.73%
July 1, 2007 to June 30, 2009	7.15%	9.47%	0.11%	16.73%
July 1, 2009 to June 30, 2013	7.15%	9.85%	0.11%	17.11%
July 1, 2013 to June 30, 2014	8.15%	10.85%	0.11%	19.11%
July 1, 2014 to June 30, 2015	8.15%	10.95%	0.11%	19.21%
July 1, 2015 to June 30, 2016	8.15%	11.05%	0.11%	19.31%
July 1, 2016 to June 30, 2017	8.15%	11.15%	0.11%	19.41%
July 1, 2017 to June 30, 2018	8.15%	11.25%	0.11%	19.51%
July 1, 2018 to June 30, 2019	8.15%	11.35%	0.11%	19.61%
July 1, 2019 to June 30, 2020	8.15%	11.45%	0.11%	19.71%
July 1, 2020 to June 30, 2021	8.15%	11.55%	0.11%	19.81%
July 1, 2021 to June 30, 2022	8.15%	11.65%	0.11%	19.91%
July 1, 2022 to June 30, 2023	8.15%	11.75%	0.11%	20.01%
July 1, 2023 to June 30, 2024	8.15%	11.85%	0.11%	20.11%

Calculations based on the Market Value of Assets

MCA 19-20-201 requires this report to show how market performance is affecting the actuarial funding of the Retirement System. The July 1, 2019 market value of assets is $0.8 million greater than the actuarial value of assets. This is due to the smoothing of investment gains and losses over a four year period. If the market value of assets was used, the amortization period would be 29 years, and the Funded Ratio would be 68.64%.

Additional Details

MCA 19-20-604 states that the contribution from the State General Fund will be reduced by 0.11% when the amortization period of the System's UAAL is 10 years or less according to the System's latest actuarial valuation.

The actuarial costs are calculated using the entry age actuarial cost method. This is the method used by most public plans. It is designed to provide a stable contribution rate as a percent of member pay. This actuarial valuation measures the adequacy of the contribution rates set in Montana State Law.

Investment Experience

The market assets earned 5.69% net of investment and operating expenses. As a result of cumulative unrecognized losses, the actuarial assets earned 7.00% which is 0.50% less than the actuarial assumption of 7.50%. The return on the actuarial assets differs from the return on market assets because the actuarial value of assets spreads gains and losses over four years. The chart below shows the annual returns for the past ten years.

Year	Market Return	Actuarial Return	Market Return over Assumption	Actuarial Return over Assumption
7/1/2009 to 6/30/2010	12.87%	9.78%	5.12%	2.03%
7/1/2010 to 6/30/2011	21.67%	(0.13)%	13.92%	(7.88)%
7/1/2011 to 6/30/2012	2.21%	3.21%	(5.54)%	(4.54)%
7/1/2012 to 6/30/2013	12.94%	11.99%	5.19%	4.24%
7/1/2013 to 6/30/2014	17.09%	13.21%	9.34%	5.46%
7/1/2014 to 6/30/2015	4.57%	9.59%	(3.18)%	1.84%
7/1/2015 to 6/30/2016	2.08%	8.79%	(5.67)%	1.04%
7/1/2016 to 6/30/2017	11.92%	8.24%	4.17%	0.49%
7/1/2017 to 6/30/2018	8.82%	6.85%	1.07%	(0.90)%
7/1/2018 to 6/30/2019	5.69%	7.00%	(1.81)%	(0.50)%

Asset gains or losses result when the return on the actuarial value of assets differs from the actuarial investment return assumption of 7.50% effective July 1, 2018.

On a market value basis the System earned $43.3 million greater than anticipated by the 7.75% assumption in the year ended June 30, 2018 and $77.4 million less than anticipated by the 7.50% assumption in the year ended June 30, 2019. The net result as of July 1, 2019 is that the market value of assets is $0.8 million greater than the actuarial value of assets. This $0.8 million in unrecognized asset gains will either offset any future investment losses or if there are none, decrease the amortization period of the UAAL in future valuations.

Recent Contribution Increases

The Montana University System Retirement Program (MUS-RP) supplemental contribution ensures university member benefits are funded by university employers. The supplemental contribution was increased from 4.04% to 4.72% of MUS-RP member pay at July 1, 2007. The valuation that determined the 4.72% contribution rate of MUS-RP member pay was based on the valuation completed as of July 1, 2006. The most recent MUS-RP valuation completed as of July 1, 2018 indicated an increase is needed in the supplemental contribution rate from 4.72% to 11.89% of MUS-RP member compensation rate.

MCA 19-20-608 and MCA 19-20-609 dictate that employers and members are required to make supplemental contributions if the funded ratio of the System is less than 90%. Since the funded ratio is currently 68.63%, Tier One Members are required to contribute an additional 1% of compensation. The individual employers are required to contribute an additional 1% of compensation. The employer contribution shall increase by an additional 0.1% each year following July 1, 2013 until the total employer supplemental contribution is equal to 2% of compensation.

MCA 19-20-605 requires each employer to contribute 9.85% of total compensation paid to all re-employed TRS retirees employed in a TRS reportable position. Pursuant to MCA 19-20-609, this amount shall increase by 1.00% for fiscal year 2014 and increase by 0.10% each fiscal year through 2024 until the total employer contribution is equal to 11.85% of re-employed retiree compensation.

Amortization of the UAAL

The July 1, 2018 actuarial valuation calculated a 31 year amortization period for the UAAL. The resulting amortization period at July 1, 2019 is 29 years. The amortization period anticipates future increases in employer supplemental contributions. In addition, it anticipates future State General Fund contributions will decrease by 0.11% when the amortization period of the System's UAAL is 10 years or less. Future decreases in the Employer and Member Supplemental Contributions are not anticipated.

Funding and Benefits Policy

The Teachers' Retirement System has adopted a Funding and Benefits Policy to provide general guidelines to help ensure decisions are made based on sound, consistent, and thoroughly examined criteria. The Funding and Benefits Policy includes guidance on the following topics:

1) Additional Funding
   a) The Funding and Benefits Policy states:
      "1. If the amortization period is greater than 30 years, the actuary will recommend the single contribution rate increase that can reasonably expect to fully amortize the UAAL over a closed 30-year period effective July 1, following the next regular legislative session.
      2. If the amortization period is less than 30 years, but greater than 0, and it is projected to continue to decline over the remainder of the closed period, the actuary will not recommend a change in the statutory contribution rates.
      3. If the amortization period is less than 30 years, but has increased over prior valuations and is projected to continue to grow, the actuary will recommend a contribution rate increase that is reasonably expected to reverse the recent trend and reestablish a closed amortization period equal to that of the last valuation."
2) Analysis: The amortization period as of July 1, 2019 is 29 years based on actuarial assets and 29 years based on market assets. Assuming experience follows the actuarial assumptions, the amortization period is projected to decline.
3) Ultimate Goal
   a) The Funding and Benefits Policy states: "It is the desire of the Board to fully fund the System. However, until the System becomes fully funded, any unfunded liabilities will be amortized over a closed period of no more than 30 years and funded as a level percent of pay. At such time as the System becomes fully funded and has as stabilization reserve of at least 10% of the actuarial accrued liability, the allowed amortization period for any subsequent unfunded liabilities will be reduced to a closed period of not greater than 20 years."
   b) Analysis: The amortization period on an actuarial value of asset basis is 29 years and is anticipated to decline. It is important to note that the normal cost rate for members hired on or after July 1, 2013 is less than the rate for members hired before July 1, 2013. As members hired before July 1, 2013 terminate or retire and are replaced with members with a lower normal cost rate, more of the employer contribution will be available to amortize the UAAL. As a result, the effective amortization period is less than the amortization period calculated in the actuarial valuation, which does not reflect new hires.

4) Benefit Enhancements

a) The Funding and Benefits Policy states: “Any recommendation for a benefit enhancement must include recommendations for necessary additional funding or other benefit reduction to cover any increase in normal cost arising from the recommended enhancement and to amortize any increase in the unfunded actuarial accrued liabilities arising from the recommended enhancement over a period not to exceed 25 years.

The Board will determine its position with respect to supporting or opposing legislation, on a case-by-case basis, and will apply this policy, actuarial funding standards, and other industry-standard information and resources it finds persuasive, as decision guides. The Board may not support legislation to enhance benefits if the funded ratio is less than 85%, and the amortization period is greater than 20 years.”

b) Analysis: Since the funded ratio at July 1, 2019 of 68.63% is below 80% the Board’s Funding and Benefits policy does not currently support enhanced benefits.

Sensitivity to Future Experience

The valuation results are projections based on the actuarial assumptions. Actual experience will differ from these assumptions, either increasing or decreasing the ultimate cost. The following illustrations provide simple analyses on how the costs are sensitive to changes in the assumed rate of return.

Investment Return – The investment return generally has the largest impact on the funding of the System.

Impact of Assuming 1.0% Higher Investment Return			
	Funded Ratio	Amortization Period	Actuarially Determined Employer Contribution (Millions $)*
Current Assumption 7.50%	68.63%	29 Years	$99.1
Higher Assumption 8.50%	75.97%	14 Years	55.2
Change - Increase / (Decrease)	7.34%	(15) Years	($43.9)

Impact of Assuming 0.5% Higher Investment Return			
	Funded Ratio	Amortization Period	Actuarially Determined Employer Contribution (Millions $)*
Current Assumption 7.50%	68.63%	29 Years	$99.1
Higher Assumption 8.00%	72.27%	20 Years	76.0
Change - Increase / (Decrease)	3.64%	(9) Years	($23.1)

Impact of Assuming 0.5% Lower Investment Return			
	Funded Ratio	Amortization Period	Actuarially Determined Employer Contribution (Millions $)*
Current Assumption 7.50%	68.63%	29 Years	$99.1
Lower Assumption 7.00%	65.05%	44 Years	120.5
Change - Increase / (Decrease)	(3.58)%	15 Years	$21.4

Impact of Assuming 1.0% Lower Investment Return			
	Funded Ratio	Amortization Period	Actuarially Determined Employer Contribution (Millions $)*
Current Assumption 7.50%	68.63%	29 Years	$99.1
Lower Assumption 6.50%	61.53%	81 Years	144.6
Change - Increase / (Decrease)	(7.10)%	52 Years	$45.5

* Amounts reflect estimated increase/(decrease) in FY2020 employer contributions only, in order to maintain the 29 year amortization period.

The future funding status of the System will be determined by the System's experience. The System's actual asset returns and retirement rates, as well as member longevity, salary increases, withdrawal rates, disability rates and future legislation will all impact the funding status of the System. The entry age normal cost method and four year smoothing of asset gains and losses will help to provide a more orderly funding of the System's liabilities, but will not change the actual experience. The amortization period of the UAAL is not likely to decrease by the expected 1.0 year with each passing actuarial valuation. Instead, the amortization period is expected to decrease more or less than 1.0 years each year, reflecting gains and losses due to experience different than the actuarial assumptions.

Assumption Changes

There have been no assumption changes since the previous valuation.

Benefit Changes

There have been no benefit changes since the previous valuation that would have a material effect on the liabilities of the System.

Contribution Changes

An employer supplemental contribution of 1% of compensation is required beginning in fiscal year 2014 which will increase by 0.10% each subsequent fiscal year through 2024. For fiscal years beginning after June 30, 2024, the supplemental employer contribution will equal 2.00% of compensation.

Method Changes

The Guaranteed Annual Benefit Adjustment (GABA) for Tier Two members is a variable rate between 0.50% and 1.50% as determined by the Board. Since an increase in the amount of the GABA is not automatic and must be approved by the Board, we have lowered the assumed increase from 1.50% to the current rate of 0.50% per annum.

Impact of Changes

The following table summarizes how experience has changed the UAAL since the July 1, 2018 Actuarial Valuation. Further detail can be found in Table 12.

Changes in the Unfunded Actuarial Accrued Liability (UAAL)

(In millions)

July 1, 2018 Valuation UAAL	$ 1,910.0
Expected Decrease	(1.7)
Expected July 1, 2019 UAAL	$ 1,908.3
Experience Loss on Actuarial Liabilities	$ 6.7
Experience Loss on Actuarial Assets	20.1
Assumption & Method Changes	(6.1)
Plan Changes	0.0
Total Loss	$ 20.7
July 1, 2019 Valuation UAAL	$ 1,929.0

Summary

- The System's actuarial value investment return of 7.00% for the year ended June 30, 2019 is (0.50)% less than the actuarial assumption of 7.50%. This represents an asset loss of 20.1 million due to investment return less than anticipated. The actuarial value of assets is not allowed to be greater than 120% or less than 80% of the market value of assets. As of July 1, 2019, the market value of assets was $4,220.3 million. As of July 1, 2019 the preliminary actuarial value of assets was $4,219.5 million. Since the preliminary actuarial value is within the corridor no adjustment is required to the preliminary actuarial value of assets. The July 1, 2019 market value of assets is $0.8 million greater than the actuarial value of assets. This $0.8 million gain will be recognized in future actuarial valuations unless it is offset by returns less than the 7.50% assumption.

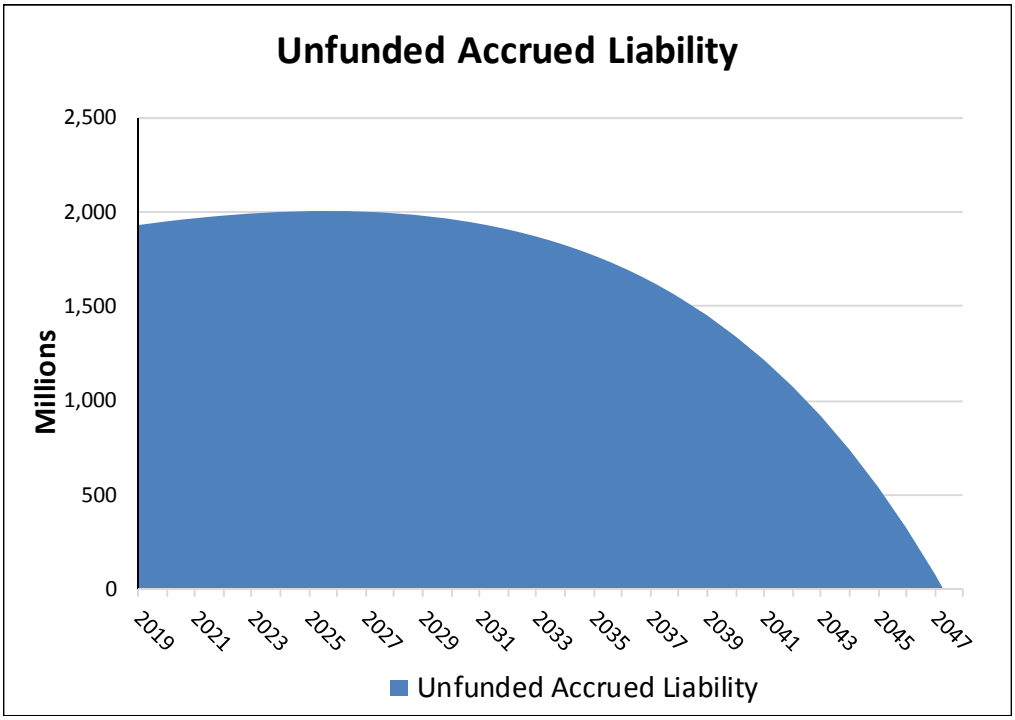
- As of July 1, 2019 the amortization period of the UAAL is 29 years. Prior to this valuation the funding period was 31 years. The ultimate goal of the Board's Funding and Benefits Policy is to increase the current net funded ratio of 68.63% above 110% to encourage stable contribution rates.

- The funding of the retirement system will be impacted by future experience which will sometimes be more favorable than the actuarial assumptions and sometimes less favorable. In particular, investment returns larger and smaller than the 7.50% assumption are expected to have significant impacts on the System's funding progress. In the long term, the favorable experience is needed to offset the less favorable experience. This is the reason for using an actuarial value of assets that smoothes gains and losses over four years.

- The unfunded actuarial accrued liability is amortized using a level percentage of payroll method over the amortization period. Under the level percentage of payroll method, amortization payments will not be large enough to cover interest on the UAAL in the beginning of the amortization schedule, which means that as a dollar amount, the UAAL is expected to grow. After a period of time, amortization payments will be large enough that the amortization payments will cover both interest and principal, and the UAAL as a dollar amount will be projected to decrease in each subsequent year. The payroll growth assumption is used to determine the percentage of payroll required over the remaining amortization period to fully amortize the UAAL. The payroll growth assumption is 3.25%.

Projected Progress toward 100% Funding

The table below shows the projected progress toward reaching 100%. When the System is 100% funded the Unfunded Actuarial Accrued Liability will be fully amortized. This is scheduled to occur within 29 years. The ultimate goal of the TRS System is to become at least 100% funded and to establish a reserve equal to 10% of the System's Actuarial Accrued Liability.



Section 2

Assets

In many respects, an actuarial valuation can be regarded as an inventory process. The inventory is taken as of the actuarial valuation date, which for this valuation is July 1, 2019. On that date, the assets available for the payment of benefits are appraised. These assets are compared with the actuarial liabilities. The actuarial process thus leads to a method of determining what contributions by members and their employers are needed to strike a balance.

The asset valuation method being used is a four-year smoothing method. The expected return is determined each year based on the beginning of year market value and actual cash flows during the year. Any difference between the expected market value return and the actual market value return is recognized evenly over a period of four years. The actuarial value of assets is not allowed to be greater than 120% or less than 80% of the market value of assets.

Table 1 lists the assets held and their market value for the past two years. Table 2 summarizes the fund's activity during the past two years. Table 3 summarizes the determination of the actuarial value of assets. Table 4 summarizes historical asset returns for the last 15 years including the amount recognized by the actuarial asset valuation method which was greater or lesser than the actuarial investment return assumption. Table 5 summarizes the historical asset returns since 1997 on market value and actuarial value basis. Table 5 also shows the assumed rate of return since 1995 which was reduced to 7.75% and 7.50% in Fiscal Years Ending 2005 and 2019, respectively. Table 6 summarizes the historical asset values on a market value and actuarial value basis.

Teachers' Retirement System
State of Montana

Table 1

Statement of Fiduciary Net Assets

	TOTAL TRS 2019	TOTAL TRS 2018
ASSETS		
Cash/Cash Equivalents-Short Term		
Investment Pool	$ 137,714,031	$ 93,460,641
Receivables:		
Accounts Receivable	16,252,285	21,518,287
Interest Receivable	273,021	159,755
Total Receivables	$ 16,525,306	$ 21,678,042
Investments, at fair value:		
Investment Pools	4,065,250,746	4,032,277,147
Other Investments	-	-
Securities Lending Collateral	19,323,932	26,245,686
Total Investments	$ 4,084,574,678	$ 4,058,522,833
Assets Used in Plan Operations:		
Land and Buildings	$ 193,844	$ 193,844
Less: Accumulated Depreciation	(150,545)	(150,545)
Equipment	1,061,155	1,721,073
Less: Accumulated Depreciation	(16,286)	(16,286)
Construction Work in Progress	1,505,103	786,729
Intangible Assets, net of amortization	-	-
Total Other Assets	2,593,271	2,534,815
TOTAL ASSETS	$ 4,241,407,286	$ 4,176,196,331
Pension Deferred Outflows	$ 331,069	$ 436,537
OPEB Deferred Outflows	$ 116,631	$ 121,739
LIABILITIES		
Accounts Payable	$ 247,796	$ 130,252
Securities Lending Liability	19,323,932	26,245,686
Compensated Absences	168,204	156,460
OPEB Implicit Rate Subsidy	135,851	138,145
Net Pension Liability	1,443,205	1,745,607
TOTAL LIABILITIES	$ 21,318,986	$ 28,416,150
Pension Deferred Inflows	$ 250,248	$ 14,251
OPEB Deferred Inflows	$ -	
NET ASSETS HELD IN TRUST FOR PENSION BENEFITS	**$ 4,220,285,752**	**$ 4,148,324,206**

Teachers' Retirement System
State of Montana

Table 2

Statement of Changes in Fiduciary Net Assets

	TOTAL TRS 2019	TOTAL TRS 2018
ADDITIONS		
Contributions:		
Employer	$ 97,303,048	$ 94,233,469
Plan Member	78,150,923	75,594,333
Other	45,495,334	45,005,672
Total Contributions	$ 220,949,305	$ 214,833,474
Misc Income	$ 31,040	$ 31,829
Investment Income:		
Net Appreciation/(Depreciation) in Fair Value of Investments	$ 250,387,940	$ 353,254,843
Investment Earnings	2,647,387	15,247,636
Security Lending Income	1,035,829	794,534
Investment Income/(Loss)	$ 254,071,155	$ 369,297,013
Less: Investment Expense	25,659,055	25,259,126
Less: Security Lending Expense	519,813	317,054
Net Investment Income/(Loss)	$ 227,892,287	$ 343,720,833
Total Additions	$ 448,872,632	$ 558,586,136
DEDUCTIONS		
Benefit Payments	$ 367,779,905	$ 352,854,025
Withdrawals	6,008,447	5,322,642
Administrative Expense	2,947,109	2,849,527
OPEB Expenses	6,987	(89,962)
Pension Expense	167,489	247,739
Total Deductions	$ 376,909,937	$ 361,183,972
NET INCREASE (DECREASE) IN PLAN NET ASSETS	$ 71,962,695	$ 197,402,165
NET ASSETS HELD IN TRUST FOR PENSION BENEFITS BEGINNING OF YEAR	$ 4,148,324,206	$ 3,950,704,563
ADJUSTMENT	(1,149)	217,479
END OF YEAR	$ 4,220,285,752	$ 4,148,324,206

Teachers' Retirement System
State of Montana
Table 3
Determination of Actuarial Value of Assets

Valuation Date July 1:	2018	2019	2020	2021	2022
A. Actuarial Value Beginning of Year	$ 3,973,519,183	$ 4,094,392,530			
B. Market Value End of Year	4,148,324,206	4,220,285,752			
C. Market Value of Beginning of Year	3,950,704,563	4,148,324,206			
D. Cash Flow					
D1. Contributions	214,833,474	220,949,305			
D2. Benefit Payments	(358,176,667)	(373,788,352)			
D3. Administrative Expenses	(2,849,527)	(2,947,109)			
D4. Pension and OPEB Expenses	(157,777)	(174,476)			
D5. Net	$ (146,350,497)	$ (155,960,632)			
E. Investment Income					
E1. Market Total: B. - C. - D5.	$ 343,970,140	$ 227,922,178			
E2. Assumed Rate	7.75%	7.50%			
E3. Amount for Immediate Recognition	300,672,413	305,275,792			
E4. Amount for Phased-in Recognition	43,297,727	(77,353,614)			
F. Phased-In Recognition of Investment Income					
F1. Current Year: 0.25 * E4.	$ 10,824,432	$ (19,338,404)	$ -	$ -	$ -
F2. First Prior Year	37,137,003	10,824,432	(19,338,404)	-	-
F3. Second Prior Year	(52,815,617)	37,137,003	10,824,432	(19,338,404)	-
F4. Third Prior Year	(28,594,387)	(52,815,617)	37,137,003	10,824,432	(19,338,404)
F5. Total Recognized Investment Gain	$ (33,448,569)	$ (24,192,586)	$ 28,623,031	$ (8,513,972)	$ (19,338,404)
G. Preliminary Actuarial Value End of Year A. + D5. + E3. + F5.	$ 4,094,392,530	$ 4,219,515,104			
H. Corridor					
H1. 80% of Market Value	$ 3,318,659,365	$ 3,376,228,602			
H2. 120% of Market Value	4,977,989,047	5,064,342,902			
I. Actuarial Value End of Year G. Not Less than H1. or Not Greater than H2.	$ 4,094,392,530	$ 4,219,515,104			
J. Difference Between Market & Actuarial Values	$ 53,931,676	$ 770,648			

Teachers' Retirement System
State of Montana

Table 4

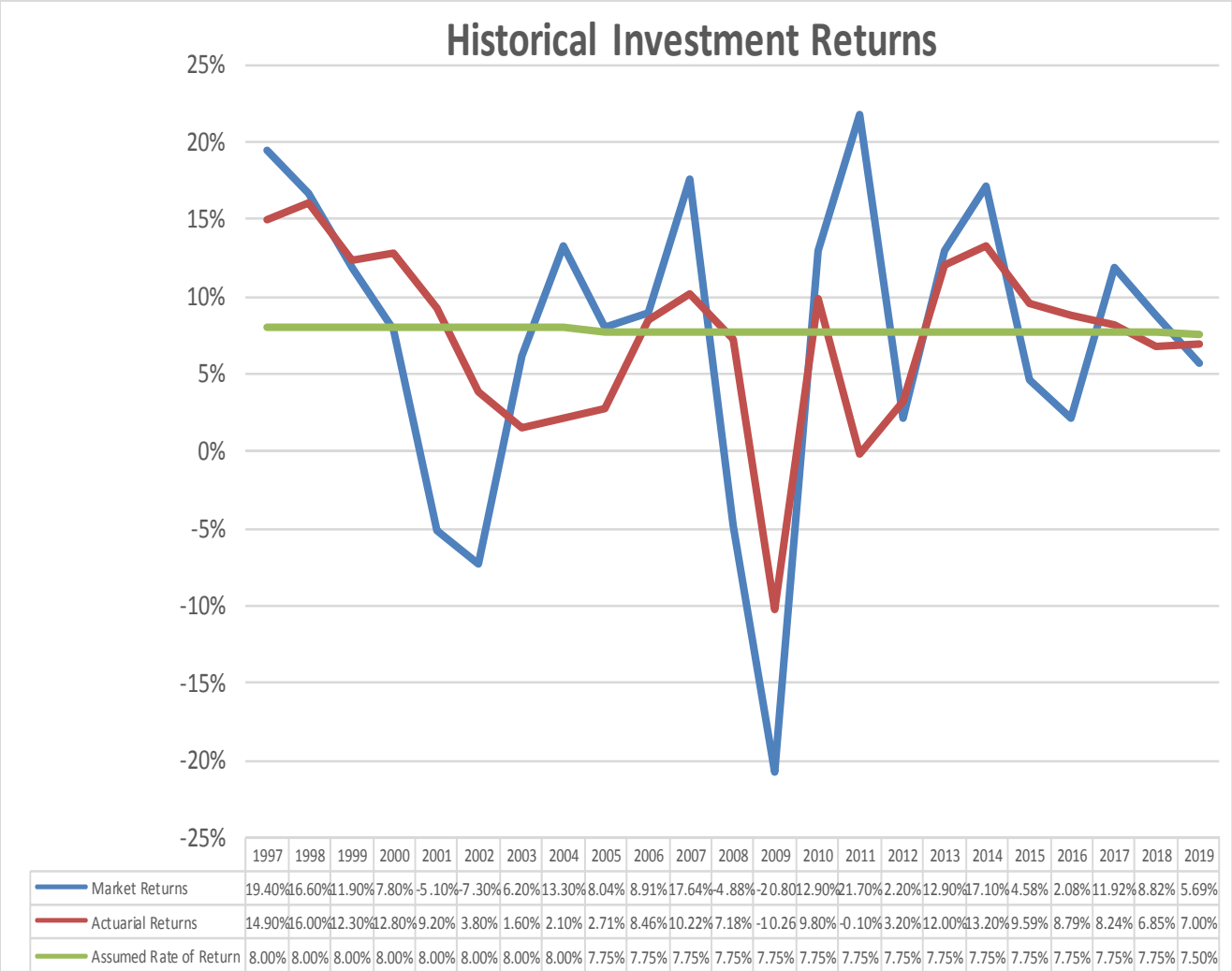
Historical Investment Returns*

Fiscal Year Ending	Market Returns	Actuarial Returns	Actuarial Return Over 7.75% Assumption
June 30, 2005	8.0%	2.7%	(5.0)%
June 30, 2006	8.9%	8.5%	0.7%
June 30, 2007	17.6%	10.2%	2.5%
June 30, 2008	(4.9)%	7.2%	(0.6)%
June 30, 2009	(20.8)%	(10.3)%	(18.0)%
June 30, 2010	12.9%	9.8%	2.0%
June 30, 2011	21.7%	(0.1)%	(7.9)%
June 30, 2012	2.2%	3.2%	(4.6)%
June 30, 2013	12.9%	12.0%	4.3%
June 30, 2014	17.1%	13.2%	5.5%
June 30, 2015	4.6%	9.6%	1.8%
June 30, 2016	2.1%	8.8%	1.0%
June 30, 2017	11.9%	8.2%	0.5%
June 30, 2018	8.8%	6.9%	(0.9)%
Fiscal Year Ending	**Market Returns**	**Actuarial Returns**	**Actuarial Return Over 7.50% Assumption**
June 30, 2019	5.7%	7.0%	(0.5)%
15 Year Average	6.7%	6.3%	(1.4)%

* Returns reflect all investment returns, including investment income and realized and unrealized investment gains and losses, and are net of investment expenses and administrative expenses paid by the System.

Teachers' Retirement System
State of Montana

Table 5

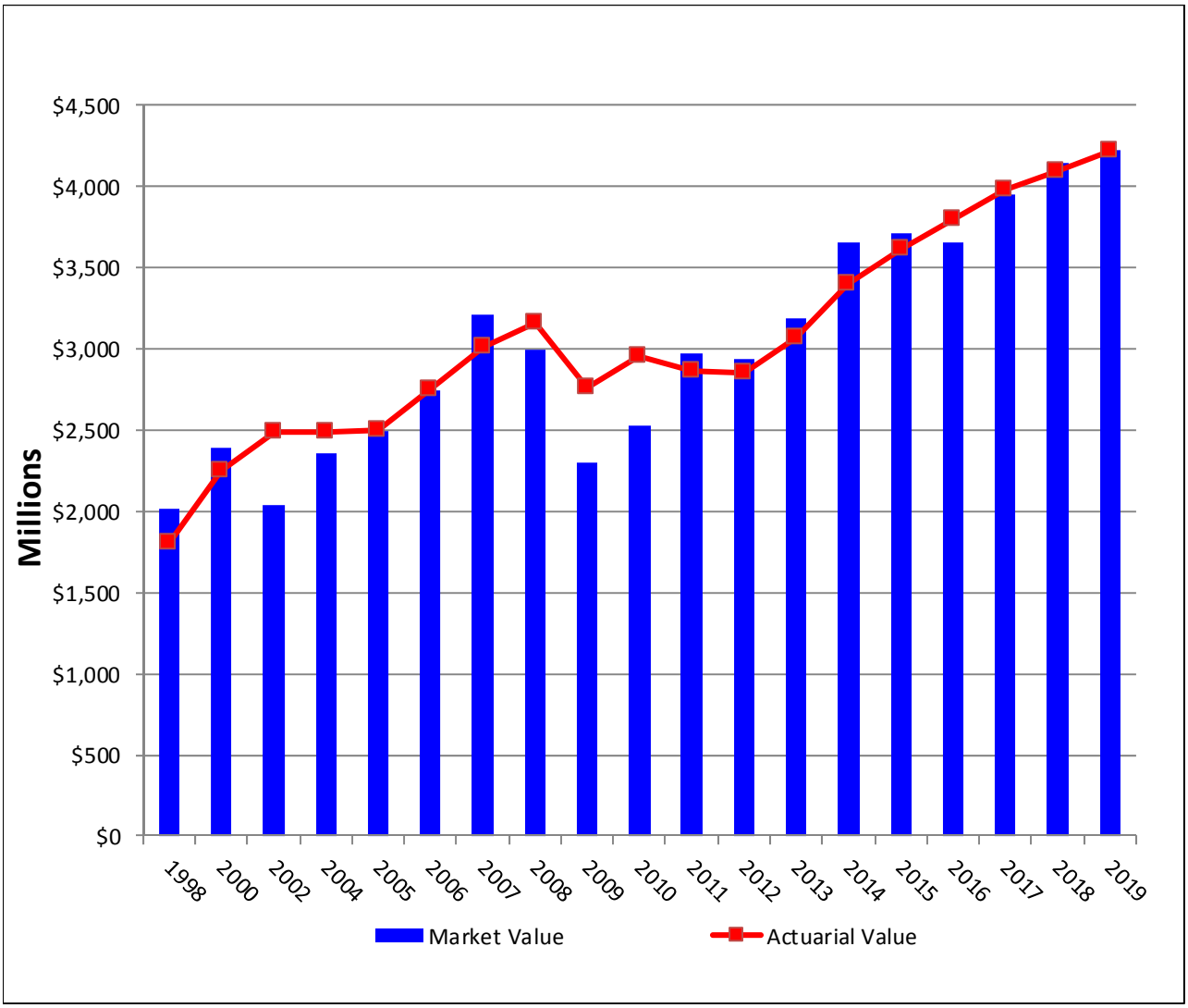


	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Market Returns	19.40%	16.60%	11.90%	7.80%	-5.10%	-7.30%	6.20%	13.30%	8.04%	8.91%	17.64%	-4.88%	-20.80%	12.90%	21.70%	2.20%	12.90%	17.10%	4.58%	2.08%	11.92%	8.82%	5.69%
Actuarial Returns	14.90%	16.00%	12.30%	12.80%	9.20%	3.80%	1.60%	2.10%	2.71%	8.46%	10.22%	7.18%	-10.26	9.80%	-0.10%	3.20%	12.00%	13.20%	9.59%	8.79%	8.24%	6.85%	7.00%
Assumed Rate of Return	8.00%	8.00%	8.00%	8.00%	8.00%	8.00%	8.00%	8.00%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.50%

Teachers' Retirement System
State of Montana

Table 6

Market Value of Assets vs. Actuarial Value of Assets



Teachers' Retirement System
State of Montana

Section 3

Actuarial Present Value of Future Benefits

In the previous section, an actuarial valuation was related to an inventory process, and an analysis was given of the inventory of assets of the System as of the valuation date. In this section, the discussion will focus on the commitments of the System, which will be referred to as its actuarial liabilities.

Table 7 contains an analysis of the actuarial present value of all future benefits for contributing members, for former contributing members, and for beneficiaries. The analysis is given by type of benefit.

The actuarial liabilities summarized in Table 7 include the actuarial present value of all future benefits expected to be paid with respect to each member covered as of the valuation date. For an active member, this value includes a measure of both benefits already earned and future benefits to be earned. Thus, for all members, active and retired, the value extends over benefits earnable and payable for the rest of their lives and, if an optional benefit is chosen, for the lives of their surviving beneficiaries.

The actuarial valuation does not recognize liabilities for employees who become members and participate in the System after the valuation date.

Teachers' Retirement System
State of Montana

Table 7

Actuarial Present Value of Future Benefits for Contributing Members, Former Contributing Members, and Beneficiaries

(All amounts are actuarial present values in millions)

	July 1, 2019 Total	July 1, 2018 Total
A. Active Members		
Service Retirement	$ 2,273.9	$ 2,250.6
Disability Retirement	15.0	14.7
Survivors' Benefits	48.9	48.3
Vested Retirement	46.8	44.9
Refund of Member Contributions	45.0	42.7
Total	$ 2,429.6	$ 2,401.2
B. Inactive Members and Annuitants		
Service Retirement	$ 3,930.6	$ 3,806.1
Disability Retirement	26.9	25.4
Beneficiaries*	264.3	252.2
Vested Terminated Members	104.9	114.4
Refund of Member Contributions	24.1	25.3
Total	$ 4,350.8	$ 4,223.4
C. Grand Total	$ 6,780.4	$ 6,624.6

* Includes survivors of active and retired members and children's benefits

Teachers' Retirement System
State of Montana

Section 4

Employer Contributions

In the previous two sections, attention has been focused on the assets and the present value of all future benefits of the System. A comparison of Tables 3 and 7 indicates that there is a shortfall in current actuarial assets to meet the present value of all future benefits for current members and beneficiaries.

In an active system, there will always be a difference between the assets and the present value of all future benefits. An actuarial valuation sets a schedule of future contributions that will deal with this funding in an orderly fashion.

The method used to determine the incidence of the contributions in various years is called the actuarial cost method. For this valuation, the entry age actuarial cost method has been used. A description of the entry age actuarial cost method is provided in Appendix A. Under this method, or essentially any actuarial cost method, the contributions required to meet the difference between current assets and the present value of all future benefits are allocated each year between three elements:

- A normal cost amount, which ideally is relatively stable as a percentage of salary over the years;
- A load for administrative expenses; and
- An amount which is used to amortize the UAAL.

The two items described above, normal cost and UAAL, are the keys to understanding the actuarial cost method. Let us first discuss the normal cost.

The normal cost is the theoretical contribution rate, which will meet the ongoing costs of a group of average new employees. Suppose that a group of new employees were covered under a separate fund from which all benefits and to which all contributions and associated investment return were to be paid. Under the entry age actuarial cost method, the normal cost contribution rate is that level percentage of pay which would be exactly right to maintain this fund on a stable basis. If experience were to follow the actuarial assumptions exactly, the fund would be completely liquidated with the last payment to the last survivor of the group.

The assumed investment rate of return is 7.50%, net of investment expenses. As a result, the actuarially determined contribution must include an amount for administrative expenses expected to occur during the year.

We have determined the normal cost rates separately by type of benefit under the System. These are summarized in Table 8. In Table 8 we also provide a summary of the member and employer statutory contributions.

The term "fully funded" is often applied to a system where contributions for everyone at the normal cost rate will fully pay for the benefits of existing as well as new employees. Often, systems are not fully funded, either because of benefit improvements in the past that have not been completely paid for or actuarial deficiencies that have occurred because experience has not been as anticipated. Under these circumstances, a UAAL exists.

Table 9 shows how the UAAL was derived for the System. Lines A and B show, respectively, the total present value of future benefits and the portion of the future liability that is expected to be paid from future normal cost contributions, both employer and employee. Line C shows the actuarial accrued liability. Line D shows the amount of assets available for benefits. Line E shows the UAAL.

The amortization of the UAAL assumes university supplemental contributions are made as a percent of pay for members of the Montana University System Retirement Program (MUS-RP). Under Section 19-20-621, periodic separate valuations are to be performed to measure the liabilities of benefits to be paid under the Teachers' Retirement System (TRS) for MUS-RP members. The MUS-RP valuations calculate contribution rates that finance the university member benefits with university contributions and reflect actual experience including investment returns. In the prior valuations, the Supplemental Contribution of 4.72% of MUS-RP payroll was assumed to cease in 2033. It is our understanding the contribution will not stop unless legislative action is taken. The university supplemental contribution rate has varied from time to time. Recently it has varied as follows:

Supplemental University Contribution Rate	Fiscal Years Ending
2.81%	June 30, 1998
3.12%	June 30, 1999
3.42%	June 30, 2000
3.73%	June 30, 2001
4.04%	June 30, 2002 to June 30, 2007
4.72%	After June 30, 2007

The UAAL at any date after establishment of a system is affected by any actuarial gains or losses arising when the actual experience of the system varies from the experience anticipated by the actuarial assumptions used in the valuations. To the extent actual experience as it develops differs from the assumptions used, so also will the actual emerging costs differ from the estimated costs. The impact of these differences in actual experience from the assumptions is included in Section 1, the Summary of Findings.

Teachers' Retirement System
State of Montana

Table 8

Normal Cost Contribution Rates
As Percentages of Salary

	July 1, 2019 Total	July 1, 2018 Total
Service retirement	7.58%	7.75%
Disability retirement	0.08%	0.09%
Survivors' benefits	0.24%	0.25%
Vested retirement	0.52%	0.52%
Refund of member contributions	1.36%	1.35%
Total Normal Rate	9.78%	9.96%
Employee Normal Rate	8.15%	8.15%
Employer Normal Rate	1.63%	1.81%
Administrative Expense Load	0.36%	0.36%

The normal rate for members hired on or after July 1, 2013 is 9.42%. As current members retire or terminate from the System and are replaced by new hires, the normal rate of the System will decline which will increase the amount of the employer contribution that is used to eliminate the unfunded actuarial accrued liability.

Teachers' Retirement System
State of Montana

Table 9

Unfunded Actuarial Accrued Liability
(Dollar amounts in millions)

	July 1, 2019	July 1, 2018
A. Actuarial present value of all future benefits for present and former members and their survivors (Table 7)	$ 6,780.4	$ 6,624.6
B. Less actuarial present value of total future normal costs for present members	631.8	620.2
C. Actuarial accrued liability	$ 6,148.6	$ 6,004.4
D. Less assets available for benefits	4,219.6	4,094.4
E. Unfunded actuarial accrued liability	$ 1,929.0	$ 1,910.0

Teachers' Retirement System
State of Montana

Section 5

Cash Flows

The fundamental equation for funding a retirement system is that benefits and administrative expenses must be provided for by contributions (past and future) and investment income. When a retirement system matures, benefits and administrative expenses often exceed contributions. In this case we say the system has a "negative cash flow." Mature systems are characterized by negative cash flows and large pools of assets. This is natural. Actuarial funding is designed to accumulate large pools of assets which will in turn provide investment income and finance negative cash flows when systems mature. If the fund is looked at as a whole, investment income is usually larger than the difference between contributions and benefit payments. The retirement system's investment strategy should maximize potential returns at a prudent level of risk while providing for needed cash flows.

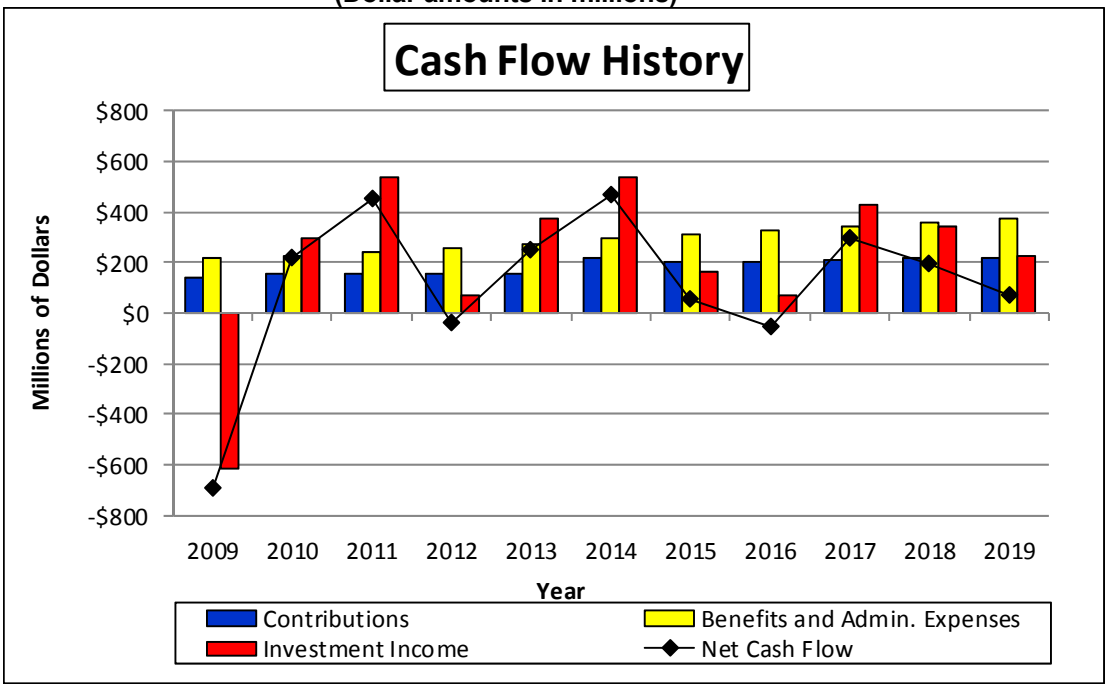
Table 10 shows the System had a positive cash flow for the year ended June 30, 2019. The System's total cash flow including benefits payments, administrative expenses and investment earnings was $71.9 million. Of the $71.9 million, ($376.9) million was due to benefit payments and expenses, which were offset by $220.9 in contributions and $227.9 in investment returns. Table 11 shows the System is projected to have a positive cash flow in all future years.

As long as the System had a positive cash flow, there was no need to plan where the funds would come from to pay benefits since benefits could be paid by incoming contributions. A negative cash flow, as defined above, requires planning what funds will be used to pay the difference between benefits and contributions. We are providing these projections to aid in developing the investment strategy for the System's assets.

Teachers' Retirement System
State of Montana

Table 10

Cash Flow History
(Dollar amounts in millions)

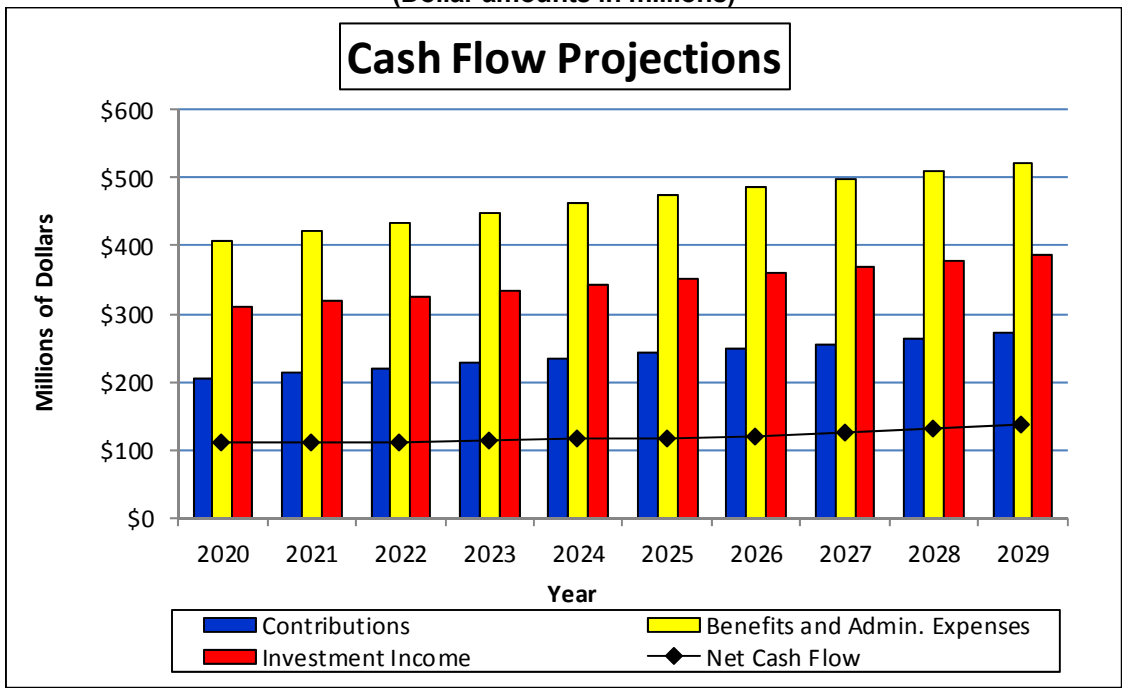


Year Ended June 30	Historical Cash Flows: Contributions	Benefits & Administrative Expenses	Investment Income	Net Cash Flow
2009	$ 138.3	$ 217.0	$ (612.8)	$ (691.5)
2010	152.3	226.3	295.0	221.0
2011	153.3	241.4	539.0	450.9
2012	152.0	258.6	66.3	(40.3)
2013	154.5	275.4	373.7	252.8
2014	218.8	292.1	540.3	467.0
2015	202.9	311.2	165.7	57.4
2016	205.3	328.4	71.5	(51.6)
2017	210.5	343.7	427.0	293.8
2018	214.8	361.2	343.7	197.3
2019	220.9	376.9	227.9	71.9

Teachers' Retirement System
State of Montana

Table 11

Cash Flow Projections
(Dollar amounts in millions)



Year Ended June 30	Projected Cash Flows: Contributions	Benefits & Administrative Expenses	Assumed Investment Income	Net Cash Flow
2020	$ 206.4	$ 405.9	$ 310.0	$ 110.5
2021	213.1	420.7	318.0	110.4
2022	220.2	434.9	326.0	111.3
2023	227.5	448.4	334.1	113.2
2024	235.0	461.5	342.4	115.9
2025	241.8	474.5	350.8	118.1
2026	248.9	487.3	359.5	121.1
2027	256.2	499.3	368.4	125.3
2028	263.7	510.4	377.6	130.9
2029	271.4	520.6	387.3	138.1

Teachers' Retirement System
State of Montana

Section 6

Actuarial Gains or Losses

An analysis of actuarial gains or losses is performed in conjunction with all regularly scheduled valuations.

The developments of the gains or losses related to the actuarial liability and the assets are shown in Table 12. The results of our analysis of the financial experience of the System in the three most recent regular actuarial valuations are presented in Table 13. Each gain or loss shown represents our estimate of how much the given type of experience caused the Unfunded Actuarial Accrued Liability or Funding Reserve to change in the period since the previous actuarial valuation.

Gains and losses shown due to demographic sources are approximate. Demographic experience is analyzed in greater detail in our periodic assumption studies.

Non-recurring gains and losses result from changes in the actuarial assumptions and benefit improvements.

Teachers' Retirement System
State of Montana

Table 12
Analysis of Actuarial Gains or Losses*

A.	ACTUARIAL ACCRUED LIABILITY (GAIN) / LOSS ANALYSIS	
1.	Actual Actuarial Accrued Liability as of June 30, 2018:	$ 6,004,434,112
2.	Normal Cost for this Plan Year (Including Expenses):	78,358,201
3.	Interest on items 1 and 2 [(1+2) x 7.50%]:	456,209,423
4.	Benefit Payments for this Plan Year (Including Expenses):	(376,909,937)
5.	Interest on item [4 x 7.50% x .5]	(14,134,123)
6.	Expected Actuarial Accrued Liability as of June 30, 2019:	$ 6,147,957,676
7.	Changes due to:	
	a. Assumption changes:	$ 0
	b. Plan amendments:	0
	c. Method changes:	(6,059,430)
	d. Actuarial (Gain) / Loss:	6,658,210
8.	Actual Actuarial Accrued Liability as of June 30, 2019:	$ 6,148,556,456
9.	Items Affecting Calculation of Actuarial Accrued Liability:	
	a. Benefit provisions reflected in the actuarial accrued liability (see Appendix B)	
	b. Actuarial assumptions and methods used to determine actuarial accrued liability (see Appendix A)	
B.	ASSET (GAIN) / LOSS ANALYSIS	
1.	Actuarial Value of Assets as of June 30, 2018:	$ 4,094,392,530
2.	Interest on item [1 x 7.50%]	307,079,440
3.	Contributions for this Plan Year	220,949,305
4.	Interest on item [3. x 7.50% x .5]	8,285,599
5.	Benefit Payments for this Plan Year (Including Expenses)	(376,909,937)
6.	Interest on item [5. x 7.50% x .5]	(14,134,123)
7.	Expected Actuarial Value of Assets as of June 30, 2019:	$ 4,239,662,814
8.	Actuarial Value of Assets as of June 30, 2019:	$ 4,219,515,104
9.	(Gain) / Loss	$ 20,147,710
C.	UNFUNDED ACTUARIAL ACCRUED LIABILITY (GAIN) / LOSS ANALYSIS	
1.	Actual Unfunded Actuarial Accrued Liability as of June 30, 2018:	$ 1,910,041,582
2.	Normal Cost for this Plan Year (Including Expenses):	78,358,201
3.	Contributions for this Plan Year:	(220,949,305)
4.	Interest on items 1 - 3: [(1+2) x 7.50% + (3 x 7.50% x .5)]	140,844,384
5.	Expected Unfunded Actuarial Accrued Liability as of June 30, 2019:	$ 1,908,294,862
6.	Changes due to:	
	a. Assumption changes:	$ 0
	b. Plan amendments:	0
	c. Method changes:	(6,059,430)
	d. Actuarial (Gain) / Loss:	26,805,920
7.	Actual Unfunded Actuarial Accrued Liability as of June 30, 2019:	$ 1,929,041,352

* Effects related to gains are shown in parentheses. Numerical results are expressed as a (decrease) increase in the Unfunded Actuarial Accrued Liability (UAAL). Gains decrease the UAAL and losses increase the UAAL.

Teachers' Retirement System
State of Montana

Table 13

Historical Actuarial Gains or Losses*
(Dollar amounts in millions)

	UAAL (Gain)/Loss		
	June 30, 2019	**June 30, 2018**	**June 30, 2017**
Investment Income Investment income was (greater) less than expected based on actuarial value of assets.	$ 20.1	$ 35.1	$ (18.2)
Pay Increases Pay increases were (less) greater than expected.	0.1	(24.2)	(14.6)
Age & Service Retirements Members retired at (older) younger ages or with (less) greater final average pay than expected	22.1	22.4	4.8
Disability Retirements Disability claims were (less) greater than expected	0.2	0.3	0.6
Death-in-Service Benefits Survivor claims were (less) greater than expected	(1.1)	(2.6)	(3.9)
Withdrawal From Employment (More) less reserves were released by withdrawals than expected	16.7	8.0	6.5
Death After Retirement Retirees (died younger) lived longer than expected	12.2	12.6	13.8
Data Adjustments and Benefit Payment Timing Service purchases, data corrections, etc.	(43.6)	(0.4)	(1.3)
Other Miscellaneous (gains) and losses	0.1	1.5	(0.9)
Total (Gain) or Loss During Period From Financial Experience	$ 26.8	$ 52.7	$ (13.2)
Non-Recurring Items. Changes in actuarial assumptions and methods	(6.1)	206.3	-
Changes in benefits caused a (gain) loss	-	-	-
Composite (Gain) Loss During Period	$ 20.7	$ 259.0	$ (13.2)

* Effects related to gains are shown in parentheses. Numerical results are expressed as a (decrease) increase in the Unfunded Actuarial Accrued Liability (UAAL). Gains decrease the UAAL and losses increase the UAAL.

Teachers' Retirement System
State of Montana

Section 7

Risk Considerations

Actuarial Standards of Practice are issued by the Actuarial Standards Board and are binding on credentialed actuaries practicing in the United States. These standards generally identify what the actuary should consider, document and disclose when performing an actuarial assignment. In September, 2017, Actuarial Standard of Practice Number 51, *Assessment and Disclosure of Risk in Measuring Pension Obligations*, (ASOP 51) was issued as final with application to measurement dates on or after November 1, 2018. This ASOP, which applies to funding valuations, actuarial projections, and actuarial cost studies of proposed plan changes, is first applicable for the June 30, 2019 actuarial valuation for the System.

A typical retirement plan faces many different risks, but the greatest risk is the inability to make benefit payments when due. If plan assets are depleted, benefits may not be paid which could create legal and litigation risk or the plan could become "pay as you go". The term "risk" is most commonly associated with an outcome with undesirable results. However, in the actuarial world, risk can be translated as uncertainty. The actuarial valuation process uses many actuarial assumptions to project how future contributions and investment returns will meet the cash flow needs for future benefit payments. Of course, we know that actual experience will not unfold exactly as anticipated by the assumptions and that uncertainty, whether favorable or unfavorable, creates risk. ASOP 51 defines risk as the potential of actual future measurements to deviate from expected results due to actual experience that is different than the actuarial assumptions.

The various risk factors for a given plan can have a significant impact – positive or negative – on the actuarial projection of liability and contribution rates.

There are a number of risks inherent in the funding of a defined benefit plan. These include:

- economic risks, such as investment return and price inflation;
- demographic risks such as mortality, payroll growth, aging population including impact of baby boomers, and retirement ages;
- contribution risk, i.e., the potential for contribution rates to be too high for the plan sponsor/employer to pay and
- external risks such as the regulatory and political environment.

There is a direct correlation between healthy, well-funded retirement plans and consistent contributions that are sufficient to fund the System. The System is primarily funded by member, employer and State contributions to the trust fund, together with the earnings on these accumulated contributions. These contributions fund benefit accruals for current active members and administrative expenses. The remainder of the contributions amortizes the unfunded actuarial accrued liability. The contributions are set in statute and are intended to provide the needed amounts to fund the system over time. The purpose of the valuation is to determine if these contributions are sufficient to fund the System. Due to the fixed nature of the contributions actuarial gains and losses are reflected in the amortization period. Generally, the largest source of actuarial gains and losses are caused by investment volatility. In addition, the unfunded liability is amortized as a level percentage of pay assuming payroll will grow by 3.25% per year. A key risk factor to the System's funding is that over time, the Statutory Contribution Rates will be insufficient to accumulate enough funds, with investment income, to fund the promised benefits. The funding insufficiency can be caused by amortization periods that are too long or by payroll not growing at the assumed rate.

The other significant risk factor for the System is investment return because of the volatility of returns and the size of plan assets compared to payroll. This is to be expected, given the underlying capital market assumptions and the System's asset allocation. To the extent that the investment return on the market value of assets cannot achieve the assumed investment rate of return, there is a risk of change to the discount rate which determines the present value of liabilities and actuarial valuation results. Please see the summary of results of this report which demonstrates the sensitivity of valuation results to differing discount rates.

A key demographic risk for the Retirement System is improvements in mortality (longevity) greater than anticipated. While the actuarial assumptions reflect a margin for improvement in mortality experience these assumptions are refined every experience study, the risk arises because there is a possibility of some sudden shift, perhaps from a significant medical breakthrough that could quickly increase liabilities. Likewise, there is some possibility of a significant public health crisis that could result in a significant number of additional deaths in a short time period, which would also be significant, although more easily absorbed. While either of these events could happen, it represents a small probability and thus represents much less risk than the volatility associated with investment returns.

The exhibits on the following pages summarize some historical information that helps indicate how certain key risk metrics have changed over time. Many are due to the maturing of the retirement system.

Historical Asset Volatility Ratios

As a retirement system matures, the size of the market value of assets increases relative to the covered payroll of active members, on which the System is funded. The size of the plan assets relative to covered payroll, sometimes referred to as the asset volatility ratio, is an important indicator of the contribution risk for the System. The higher this ratio, the more sensitive a plan's contribution rate is to investment return volatility. In other words, it will be harder to recover from investment losses with increased contributions.

Actuarial Valuation Date	Market Value of Assets	Estimated Plan Year Payroll	Asset Volatility Ratio
7/1/2015	3,708,385,838	768,718,699	4.82
7/1/2016	3,656,830,798	795,920,906	4.59
7/1/2017	3,950,704,563	818,122,561	4.83
7/1/2018	4,148,324,206	829,708,595	5.00
7/1/2019	4,220,285,752	857,467,932	4.92

The assets at July 1, 2019 are 492% of payroll, so underperforming the investment return assumption by 1.00% (i.e., earn 6.50% for one year) is equivalent to 4.92% of payroll. While the actual impact in the first year is mitigated by the asset smoothing method and amortization of the UAL, this illustrates the risk associated with volatile investment returns.

Historical Cash Flows

Plans with negative cash flows will experience increased sensitivity to investment return volatility. Cash flows, for this purpose, are measured as contributions less benefit payments and administrative expenses. If the System has negative cash flows and then experiences returns below the assumed rate, there are fewer assets to be reinvested to earn the higher returns that typically follow. While any negative cash flow will produce such a result, it is typically a negative cash flow of more than 5% of MVA that may cause significant concerns. The System has negative cash flows which has been growing over the prior five years. This trend needs to be monitored going forward.

Fiscal Year End	Market Value of Assets (MVA)	Contributions	Benefit Payments	Net Cash Flow	Net Cash Flow as a Percent of MVA
6/30/2015	3,708,385,838	202,896,194	311,078,740	(108,182,546)	(2.92%)
6/30/2016	3,656,830,798	205,286,917	328,215,892	(122,928,975)	(3.36%)
6/30/2017	3,950,704,563	210,520,833	343,448,519	(132,927,686)	(3.36%)
6/30/2018	4,148,324,206	214,833,474	361,026,194	(146,192,720)	(3.52%)
6/30/2019	4,220,285,752	220,949,305	376,738,054	(155,788,749)	(3.69%)

Liability Maturity Measurement

Most public sector retirement systems have been in operation for many years. As a result, they have aging plan populations, and in some cases declining active populations, resulting in an increasing ratio of retirees to active members and a growing percentage of retiree liability. The retirement of the remaining baby boomers over the next decade is expected to further exacerbate the aging of the retirement system population. Retiree liability as a percentage of the total actuarial accrued liability has been growing over the last five years. As more of the total liability begins to reside with retirees, investment volatility has a greater impact on the funding of the system since it is more difficult to restore the system financially after losses occur when there is comparatively less payroll over which to spread costs. Below are two tables which demonstrate the ratio of the System's retiree liability compared to the total accrued liability and the ratio of the number of retirees and beneficiaries to the number of active members.

Valuation Date	Retiree Liability (a)	Total Actuarial Accrued Liability (b)	Retiree Percentage (a) / (b)
7/1/2015	3,609,722,311	5,351,391,599	67.5%
7/1/2016	3,748,186,878	5,483,673,777	68.4%
7/1/2017	3,888,518,484	5,636,841,900	69.0%
7/1/2018	4,223,371,459	6,004,434,112	70.3%
7/1/2019	4,350,787,062	6,148,556,456	70.8%

Historical Member Statistics

Valuation Date July 1,	Number of Active	Number of Retired	Active/ Retired
2015	18,316	14,839	1.23
2016	19,048	15,164	1.26
2017	18,917	15,566	1.22
2018	19,267	15,933	1.21
2019	19,686	16,256	1.21

Teachers' Retirement System
State of Montana

Appendix A

Actuarial Procedures and Assumptions

The assumptions for investment return, price inflation, wage inflation, mortality, retirement and withdrawal have been updated to reflect the experience study for the period ending July 1, 2017 adopted by the Board on May 18, 2018.

The current asset valuation method was adopted for the July 1, 2007 valuation.

Tables A-3 through A-6 give rates of decrement for service retirement, disablement, mortality, and other terminations of employment.

Actuarial Cost Method

The actuarial valuation was prepared using the entry age actuarial cost method. Under this method, the actuarial present value of the projected benefits of each individual included in the valuation is allocated as a level percentage of the individual's projected compensation between entry age and assumed exit. The portion of this actuarial present value allocated to a valuation year is called the normal cost. The normal cost was first calculated for each individual member. The normal cost rate is defined to equal the total of the individual normal costs, divided by the total pay rate.

The portion of this actuarial present value not provided for at a valuation date by the sum of (a) the actuarial value of the assets and (b) the actuarial present value of future normal costs is called the UAAL. The UAAL is amortized as a level percentage of the projected salaries of present and future members of the System.

Records and Data

The data used in the valuation consist of financial information; records of age, sex, service, salary, contribution rates, and account balances of contributing members; and records of age, sex, and amount of benefit for retired members and beneficiaries. All of the data were supplied by the System and are accepted for valuation purposes without audit.

Replacement of Terminated Members

The ages at entry and distribution by sex of future members are assumed to average the same as those of the present members they replace. If the number of active members should increase, it is further assumed that the average entry age of the larger group will be the same, from an actuarial standpoint, as that of the present group. Under these assumptions, the normal cost rates for active members will not vary with the termination of present members.

Employer Contributions

At the time of this valuation, the total employer contribution rate for normal costs and amortization of the UAAL was 11.56% of members' salaries. The employer contribution rate will increase by 0.10% each year beginning July 1, 2014 until the total employer contribution rate equals 11.96%.

Administrative and Investment Expenses

The investment expenses of the System are assumed to be funded by investment earnings in excess of 7.50% per year.

Administrative expenses are assumed to equal 0.36% of covered payroll.

Valuation of Assets - Actuarial Basis

The actuarial asset valuation method spreads asset gains and losses over four years. The expected return is determined each year based on the beginning of year market value and actual cash flows during the year. Any difference between the expected market value return and the actual market value return is recognized evenly over a period of four years. The actuarial value of assets is not allowed to be greater than 120% or less than 80% of the market assets. (Adopted effective July 1, 2007.)

Investment Earnings

The annual rate of investment earnings of the assets of the System is assumed to be 7.50% per year net of investment expenses, compounded annually. (Adopted effective May 18, 2018)

Interest on Member Contributions

Interest on member contributions is assumed to accrue at a rate of 5% per annum, compounded annually. This assumption was set as of July 1, 2004.

Postretirement Benefit Increases

Tier 1 Members:

> On January 1 of each year, the retirement allowance payable is increased by 1.5% if the retiree has received benefits for at least 36 months prior to January 1 of the year in which the adjustment is to be made.

Tier 2 Members:

> On January 1 of each year, the retirement allowance payable is assumed to increase by 0.5% if the retiree has received benefits for at least 36 months prior to January 1 of the year in which the adjustment is to be made.

Future Salaries

The rates of annual salary increase assumed for the purpose of the valuation are illustrated in Table A-2. In addition to increases in salary due to merit and longevity, this scale includes an assumed 3.25% annual rate of increase in the general wage level of the membership. The merit and longevity increases for the MUS members did not show a pattern of increasing or decreasing with service at the time of our most recent study. Therefore, the MUS members have a flat 1% merit and longevity assumption. The general wage increase assumption was adopted May 18, 2018 and the merit and longevity scales were adopted July 1, 2002.

Montana University System (MUS) members are assumed to have a 0.63% higher average final compensation to account for the larger than average annual compensation increases observed in the years immediately preceding retirement.

Service Retirement

Table A-3 shows the annual assumed rates of retirement among members eligible for service retirement. Separate rates are used when a member is eligible for reduced benefits, for the first year a member is eligible for full benefits, and for the years following the first year a member is eligible for full benefits. The rates for General Members were adopted May 18, 2018. The rates for University Members were adopted May 18, 2018.

Disablement

The rates of disablement used in this valuation are illustrated in Table A-4. These rates were adopted May 13, 2010.

Mortality

The mortality rates used in this valuation are illustrated in Table A-5. A written description of each table used is included in Table A-1. These rates were adopted May 18, 2018.

Other Terminations of Employment

The rates of assumed future withdrawal from active service for reasons other than death, disability or retirement are shown for representative ages in Table A-6. These rates were adopted May 18, 2018.

Benefits for Terminating Members

Members terminating with less than five years of service are assumed to request an immediate withdrawal of their contributions with interest. Table A-7 shows the assumed probability of retaining membership in the System among members terminating with five or more years of service. These rates were adopted July 1, 2002.

We estimated the present value of future benefits for terminated vested members based on the greater of the present value of their deferred benefit at age 60 or their available contribution account.

Part-Time Employees

The valuation data for active members identify part-time members. For part-time members earning more than $1,000, total credited service is adjusted based on the ratio of actual earnings to annualized earnings. The liability and normal cost calculations for these members are based on the adjusted service and actual earnings for the prior year.

Part-time members earning less than $1,000 during the last year were valued at their current member contribution balance.

Montana University System Retirement Program (MUS-RP)

MUS-RP payroll as of June 30, 2019 was $253,437,972.

Effective for fiscal years after June 30, 2007, the MUS-RP contribution rate is 4.72%, pursuant to MCA 19-20-621. It is our understanding the contribution will not stop unless legislative action is taken.

Buybacks, Purchase of Service, and Military Service

The active liabilities and normal cost (excluding liabilities and normal cost in respect of Return of Employee Contributions) were increased to 100.5% of their original value to fund this additional service based on a study of the System's experience for the five calendar years 1995 through 1999. Effective July 1, 2008.

Probability of Marriage & Dependent Children

If death occurs in active status, all members are assumed to have an eligible surviving spouse and two children. The spouse is assumed to be the same age as the member. For members who die prior to age 50, dependent children are assumed to be eight years old. For members who die after age 50 but prior to age 55, children are assumed to be 13 years old. Members who die after age 55 are assumed to have no dependent children under the age of 18.

Records with no Birth Date

New records with no birth date are assumed to be 25 years old. Records that are not new and have no birth date used the same birth date as the prior year's valuation.

Teachers' Retirement System
State of Montana
Table A-1
Summary of Valuation Assumptions

I.	Economic assumptions		
	A.	General wage increases* (Adopted May 18, 2018)	3.25%
	B.	Investment return (Adopted May 18, 2018)	7.50%
	C.	Price Inflation Assumption (Adopted May 18, 2018)	2.50%
	D.	Growth in membership	0.00%
	E.	Postretirement benefit increases (Starting three years after retirement)	
		Tier One	1.50%
		Tier Two	0.50%
	F.	Interest on member accounts (Adopted July 1, 2004)	5.00%
II.	Demographic assumptions		
	A.	Individual salary increase due to promotion and longevity (General Member assumptions adopted July 1, 2002) (University Member assumptions adopted July 1, 2000)	Table A-2
	B.	Retirement (adopted May 18, 2018)	Table A-3
	C.	Disablement (adopted May 13, 2010)	Table A-4
	D.	Mortality among contributing members, service retired members, and beneficiaries. The tables include margins for mortality improvement which is expected to occur in the future. For Males and Females: RP-2000 Healthy Combined Mortality Table projected to 2022 adjusted for partial credibility setback for two years (adopted May 18, 2018).	Table A-5
	E.	Mortality among disabled members For Males: RP 2000 Disabled Mortality Table, set back three years, with mortality improvements projected by Scale BB to 2022 (adopted May 18, 2018). For Females: RP 2000 Disabled Mortality Table, set forward two years, with mortality improvements projected by Scale BB to 2022 (May 18, 2018).	Table A-5
	F.	Other terminations of employment (adopted May 18, 2018)	Table A-6
	G.	Probability of retaining membership in the System upon vested termination (adopted July 1, 2002)	Table A-7

* Montana University System (MUS) members are assumed to have a 0.63% higher average final compensation to account for the larger than average annual compensation increases observed in the years immediately preceding retirement.

Teachers' Retirement System
State of Montana

Table A-2

Future Salaries

Years of Service	General Members			University Members		
	Individual Merit & Longevity	General Wage Increase	Total Salary Increase	Individual Merit & Longevity	General Wage Increase	Total Salary Increase
1	4.51%	3.25%	7.76%	1.00%	3.25%	4.25%
2	4.09	3.25	7.34	1.00	3.25	4.25
3	3.46	3.25	6.71	1.00	3.25	4.25
4	2.94	3.25	6.19	1.00	3.25	4.25
5	2.52	3.25	5.77	1.00	3.25	4.25
6	2.21	3.25	5.46	1.00	3.25	4.25
7	1.89	3.25	5.14	1.00	3.25	4.25
8	1.68	3.25	4.93	1.00	3.25	4.25
9	1.47	3.25	4.72	1.00	3.25	4.25
10	1.31	3.25	4.56	1.00	3.25	4.25
11	1.16	3.25	4.41	1.00	3.25	4.25
12	1.00	3.25	4.25	1.00	3.25	4.25
13	0.84	3.25	4.09	1.00	3.25	4.25
14	0.68	3.25	3.93	1.00	3.25	4.25
15	0.58	3.25	3.83	1.00	3.25	4.25
16	0.47	3.25	3.72	1.00	3.25	4.25
17	0.37	3.25	3.62	1.00	3.25	4.25
18	0.26	3.25	3.51	1.00	3.25	4.25
19	0.21	3.25	3.46	1.00	3.25	4.25
20	0.16	3.25	3.41	1.00	3.25	4.25
21	0.11	3.25	3.36	1.00	3.25	4.25
22 & Up	0.00	3.25	3.25	1.00	3.25	4.25

Teachers' Retirement System
State of Montana

Table A-3

Retirement
Annual Rates

	General Members			University Members		
Age	Eligible for Reduced Benefits	First Year Eligible for Full Benefits	Thereafter	Eligible for Reduced Benefits	First Year Eligible for Full Benefits	Thereafter
45		16.0%	8.0%		17.0%	8.0%
46		16.0	8.0		17.0	8.0
47		16.0	8.0		17.0	8.0
48		16.0	8.0		17.0	8.0
49	*	16.0	6.0	*	17.0	8.0
50	6.0%	9.0	5.5	7.0%	17.0	8.0
51	6.0	6.0	6.3	7.0	17.0	8.0
52	6.0	6.0	8.0	7.0	17.0	8.0
53	6.0	6.0	7.3	7.0	17.0	8.0
54	7.0	6.0	8.2	7.0	17.0	8.0
55	7.0	6.0	9.8	7.0	15.0	8.0
56	7.0	9.0	11.3	7.0	15.0	8.0
57	7.0	13.5	12.5	7.0	15.0	8.0
58	7.0	18.5	13.1	7.0	15.0	8.0
59	7.0	18.5	14.8	7.0	15.0	8.0
60	*	13.5	20.0	*	15.0	8.5
61		21.0	24.0		14.0	15.0
62		21.0	23.0		20.0	15.0
63		21.0	23.0		14.0	15.0
64		30.0	27.5		20.0	19.5
65		30.0	39.0		28.0	26.0
66		30.0	25.0		21.0	19.5
67		30.0	25.0		21.0	21.5
68		30.0	25.0		21.0	19.5
69		30.0	25.0		21.0	19.5
70		**	**		**	**

* All benefits are unreduced after attaining age 60. Reduced benefits are not available before age 50.
** Immediate retirement is assumed at age 70 or over.

Teachers' Retirement System
State of Montana

Table A-4

Disablement
Annual Rates

Age	All Members
25	.005%
30	.005
35	.008
40	.028
45	.044
50	.063
55	.084
60	.100

Teachers' Retirement System
State of Montana

Table A-5

Mortality
Annual Rates

	Contributing Members, Service Retired Members and Beneficiaries		Disabled Members	
Age	Men	Women	Men	Women
25	0.03%	0.02%	2.11%	0.70%
30	0.04	0.02	2.11	0.70
35	0.06	0.03	2.11	0.70
40	0.09	0.05	2.11	0.70
45	0.12	0.08	2.11	0.84
50	0.17	0.12	2.34	1.26
55	0.26	0.19	2.95	1.59
60	0.45	0.31	3.47	1.82
65	0.76	0.54	3.65	2.37
70	1.22	0.96	3.94	3.25
75	2.07	1.64	4.90	4.51
80	3.55	2.68	6.51	6.23
85	6.11	4.45	8.61	8.67
90	10.72	7.65	11.22	12.99
95	18.58	13.27	17.59	19.63

Teachers' Retirement System
State of Montana

Table A-6

Other Terminations of Employment
Among Members Not Eligible to Retire
Annual Rates

Years of Service	Full-time Members	Part-time Members
1	31.7%	36.0%
2	17.4	26.7
3	11.4	24.0
4	10.5	22.0
5	8.0	20.5
6	6.7	19.3
7	5.5	18.2
8	4.1	16.9
9	3.7	15.1
10	3.3	14.2
11	3.0	13.5
12	2.7	12.5
13	2.5	12.0
14	2.3	11.0
15	2.2	10.1
16	2.0	10.1
17	1.9	9.9
18	1.8	9.1
19	1.7	9.0
20	1.6	9.0
21	1.5	9.0
22	1.4	9.0
23	1.4	9.0
24	1.3	9.0

Teachers' Retirement System
State of Montana

Table A-7

Probability of Retaining Membership in the System Upon Vested Termination

Age	Probability of Retaining Membership
25	54%
30	54
35	58
40	58
45	60
50	70
55	75

Teachers' Retirement System
State of Montana

Appendix B

Summary of Benefit Provisions

Effective Date

September 1, 1937.

Vesting Period

Five years. No benefits are payable unless the member has a vested right, except the return of employee contributions with interest.

Tier One Member

A person who became a member before July 1, 2013 and who has not withdrawn the member's account balance.

Tier Two Member

A person who became a member on or after July 1, 2013, or who after withdrawing the member's account balance, became a member again after July 1, 2013.

Final Compensation

Tier One Members

Average of highest three consecutive years of earned compensation.

Tier Two Members

Average of highest five consecutive years of earned compensation.

Normal Form of Benefits

Life only annuity. All benefits cease upon death; however, in no event will the member receive less than the amount of employee contributions with interest.

Normal Retirement Benefits

Tier One Members

Eligibility: 25 years of service or age 60 with five years of service.

Benefit: The retirement benefit is equal to 1/60 of final compensation for each year of service.

Tier Two Members

Eligibility: Age 55 with 30 years of service or age 60 with five years of service.

Benefit: A member age 60 with at least 30 years of creditable service will receive a retirement allowance equal to 1.85% of final compensation for each year of service. Otherwise, the multiplier used to calculate the retirement allowance will equal 1/60 of final compensation for each year of service.

Early Retirement Benefits

Tier One Member

Eligibility: Five years of service and age 50.

Benefit: The retirement benefit is calculated in the same manner as described for normal retirement, but the benefit is actuarially reduced by the lesser of the number of years equal to the age of the participant at the early retirement subtracted from age 60 or the number of years of service at early retirement subtracted from 25 years of service.

Tier Two Member

Eligibility: Five years of service and age 55.

Benefit: The retirement benefit is calculated in the same manner as described for normal retirement, but the benefit is actuarially reduced by the lesser of the number of years equal to the age of the participant at the early retirement subtracted from age 60 or the number of years of service at early retirement subtracted from 30 years of service.

Death Benefit

Eligibility:	Five years of service.
Benefit:	The death benefit is equal to 1/60 of final compensation for each year of service accrued at date of death, with an actuarial adjustment based on the relation of the member's age at death to the beneficiary's age. A monthly benefit of $200 is paid to each child until age 18. In addition, a lump-sum benefit of $500 is paid upon the death of an active or retired member.

Disability Benefit

Eligibility:	Five years of service.
Benefit:	The disability benefit is equal to 1/60 of final compensation for each year of service accrued at date of disability. The minimum benefit is 1/4 of the final compensation. A Tier Two Member is not eligible for a disability retirement if the member is or will be eligible for a service retirement on or before the member's date of determination.

Withdrawal Benefits	With less than five years of service, the accumulated employee contributions with interest are returned. With more than five years, the member may elect a refund of contributions with interest or leave the contributions and interest in the System and retain a vested right to retirement benefits.
Contributions	Tier One Member: 7.15% of compensation. Tier One members are required to contribute a Supplemental Contribution equal to an additional 1% of compensation. The Board may decrease the Supplemental Contribution if the average funded ratio of the System based on the last three actuarial valuations is equal to or greater than 90% and the period necessary to amortize the unfunded liabilities of the System based on the most recent actuarial valuation is less than 15 years. Following one or more decreases in the supplemental contribution the Board may increase the supplemental contribution to a rate not to exceed 1% if the average funded ratio of the System based on the last three annual actuarial valuations is equal to or less than 80% and the period necessary to amortize all liabilities of the System based on the most recent annual actuarial valuation is greater than 20 years.

Tier Two Member: 8.15% of compensation. The Board may require a Tier Two member to contribute a Supplemental Contribution if the average funded ratio of the System based on the last three actuarial valuations is equal to or less than 80% and the period necessary to amortize the unfunded actuarial accrued liability is greater than 20 years and a State or employer contribution rate increase or a flat dollar contribution to the System has been enacted which is equivalent to or greater than the Supplemental Contribution Rate imposed by the Board. A singe Tier Two Supplemental Contribution Rate increase cannot exceed 0.5% of compensation and in total cannot exceed 9.15% of compensation. The Board may decrease the Supplemental Contribution if the average funded ratio of the System based on the previous three annual actuarial valuations is equal to or greater than 90%; and the period necessary to amortize the unfunded actuarial accrued liability is less than 15 years.

Employer: 9.96% of compensation. Employers are required to contribute a supplemental contribution equal to 1% for fiscal year 2014 and increase by 0.1% each fiscal year through 2024. The Board may decrease the Employer Supplemental Contribution if the average funded ratio of the System based on the last three actuarial valuations is equal to or greater than 90% and the period necessary to amortize the unfunded actuarial accrued liability based on the most recent valuation is less than 15 years and the GABA has been increased to the maximum allowable. Following one or more decreases in the Supplemental Contribution Rate the Board may increase the Supplemental Contribution Rate to a rate not to exceed 1% if the average funded ratio of the System based on the last three actuarial valuations is equal to or less than 80% and the period necessary to amortize the unfunded actuarial accrued liability is greater than 20 years.

MCA 19-20-604 specifies that the employer contribution rate will be reduced by 0.11% when the amortization period of the System's UAAL is 10 years or less according to the System's latest actuarial valuation.

State Supplemental Contribution: $25 million per year on an annual basis payable on July 1st of each year.

	Re-employed Retirees: Each employer is required to contribute 9.85% of total compensation paid to all re-employed TRS retirees employed in a TRS reportable position. This amount shall increase by 1.00% for fiscal year 2014 and increase by 0.10% each fiscal year through 2024 until the total employer contribution is equal to 11.85% of re-employed retiree compensation.
Interest on Member contributions	Effective July 1, 2019, the interest credited on member contributions increased from 1.40% to 2.30% per annum.
Guaranteed Annual Benefit Adjustment (GABA)	On January 1 of each year, if the retiree has received benefits for at least 36 months prior to January 1 of the year in which the adjustment is to be made, for Tier One Members, the retirement allowance will be increased by 1.5%. For Tier Two Members, the retirement allowance will be increased by an amount equal to or greater than 0.5% but no more than 1.5% if the most recent actuarial valuation shows the System to be at least 90% funded and the provisions of the increase is not projected to cause the funded ratio to be less than 85%.

Teachers' Retirement System
State of Montana

Appendix C

Valuation Data

This valuation is based upon the membership of the System as of July 1, 2019. Membership data were supplied by the System and accepted for valuation purposes without audit. However, tests were performed to ensure that the data are sufficiently accurate for valuation purposes.

Active Members	Number	Annual Salaries in Millions
Full-Time Members	13,196	$ 728.8
Part-Time Members*	5,798	90.1
Total Contributing Members*	18,994	$ 818.9
Active Members with Annual Compensation less than $1,000	692	
Total Active Members	19,686	

* Excludes part-time members with annual compensation less than $1,000.

Table C-1 contains summaries of the data for contributing members. For full-time members, values shown in the tables are the numbers of members and their total and average annual salaries. For part-time members, only the numbers of members are shown.

Table C-2 presents distributions of the following:

- Members receiving service retirement benefits.
- Members receiving disability retirement benefits.
- Survivors of deceased retired members receiving benefits.
- Survivors of deceased active members.
- Child beneficiaries.
- Terminated vested members.

Table C-3 is a reconciliation of membership data from July 1, 2018 to July 1, 2019.

The following is a summary of retired members and beneficiaries currently receiving benefits:

Type of Annuitant	Number	Annual Benefits in Thousands	Average Annual Benefits
Service Retirement	14,241	$ 352,767	$ 24,771
Survivors of Deceased Retired Members	1,337	22,890	17,119
Total Service Retirement (including survivors)	15,578	$ 375,657	$ 24,114
Disability Retirement	199	2,563	12,876
Survivors of Deceased Active Members	468	5,249	11,216
Child Beneficiaries	11	26	2,400
Total Annuitants	16,256	$ 383,495	$ 23,591

Terminated Members with Contributions Not Withdrawn	Number
Vested Terminated Members	1,791
Non-Vested Terminated Members	14,261
Total Terminated Members	16,052

Deceased Members Pending Account Settlement	Number
Active Deceased Pending	52
Retired Deceased Pending	67
Total Deceased Pending	119

Teachers' Retirement System
State of Montana

Table C-1

Active Members Distribution of
Full-Time Employees and Salaries
as of July 1, 2019

Number of Employees

	Completed Years of Service												
Age	0	1	2	3 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40+	Totals
<25	72	165	55	6									298
25 to 29	49	210	300	548	307								1,414
30 to 34	30	136	124	287	817	169							1,563
35 to 39	28	99	105	221	571	670	131						1,825
40 to 44	14	88	89	181	383	483	538	118					1,894
45 to 49	17	68	58	136	302	328	355	528	97				1,889
50 to 54	16	40	49	80	182	227	248	323	374	73			1,612
55 to 59	20	37	33	73	133	166	198	220	266	211	63		1,420
60 to 64	12	26	28	53	92	86	129	141	141	111	123	29	971
65 to 69	10	8	12	16	23	13	29	30	26	28	14	20	229
70 and up	6	11	3	5	4	8	2	4	7	11	7	13	81
Totals	274	888	856	1,606	2,814	2,150	1,630	1,364	911	434	207	62	13,196

Teachers' Retirement System
State of Montana

Table C-1

Active Members Distribution of
Full-Time Employees and Salaries
as of July 1, 2019

Annual Salaries in Thousands

	Completed Years of Service												
Age	0	1	2	3 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40+	Totals
<25	1,849	5,741	1,957	158									9,705
25 to 29	1,191	7,434	11,415	21,808	13,626								55,474
30 to 34	822	5,226	4,903	12,424	39,208	9,442							72,025
35 to 39	627	3,855	4,298	10,058	28,927	38,694	8,192						94,650
40 to 44	310	3,419	3,724	8,542	19,562	29,252	35,604	7,964					108,376
45 to 49	411	3,026	2,529	6,461	15,696	19,470	23,726	36,872	7,105				115,297
50 to 54	403	1,827	2,443	3,791	10,152	13,295	15,860	22,134	27,260	5,533			102,699
55 to 59	495	1,622	1,340	3,311	7,254	9,435	12,597	14,938	18,829	14,703	4,531		89,056
60 to 64	266	1,187	1,449	2,527	5,062	4,841	8,154	8,950	10,233	8,010	8,922	2,143	61,743
65 to 69	237	383	588	621	1,361	711	1,813	2,057	1,931	1,978	1,073	1,713	14,467
70 and up	409	358	182	173	222	439	110	255	545	783	660	1,203	5,339
Totals	7,018	34,078	34,828	69,874	141,070	125,579	106,057	93,171	65,903	31,007	15,186	5,059	728,831

Teachers' Retirement System
State of Montana

Table C-1

Active Members Distribution of
Full-Time Employees and Salaries
as of July 1, 2019

Average Annual Salary

	Completed Years of Service												
Age	0	1	2	3 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40+	Totals
<25	25,675	34,794	35,582	26,374									32,567
25 to 29	24,308	35,400	38,050	39,796	44,384								39,232
30 to 34	27,390	38,423	39,539	43,290	47,991	55,872							46,081
35 to 39	22,384	38,937	40,933	45,510	50,660	57,752	62,532						51,863
40 to 44	22,108	38,851	41,843	47,192	51,075	60,564	66,178	67,495					57,221
45 to 49	24,154	44,497	43,609	47,509	51,975	59,359	66,835	69,834	73,252				61,036
50 to 54	25,208	45,677	49,859	47,390	55,783	58,568	63,951	68,526	72,887	75,798			63,709
55 to 59	24,735	43,847	40,596	45,363	54,543	56,836	63,624	67,901	70,785	69,684	71,918		62,715
60 to 64	22,154	45,653	51,750	47,671	55,019	56,287	63,210	63,476	72,578	72,160	72,534	73,911	63,587
65 to 69	23,739	47,931	49,027	38,783	59,160	54,718	62,522	68,576	74,262	70,625	76,646	85,662	63,173
70 and up	68,086	32,536	60,712	34,545	55,505	54,893	55,022	63,836	77,860	71,205	94,339	92,501	65,913
Totals	25,613	38,376	40,687	43,508	50,132	58,409	65,065	68,307	72,342	71,445	73,362	81,599	55,231

Teachers' Retirement System
State of Montana

Table C-1

Active Members Distribution of Part-Time Employees
as of July 1, 2019

Number of Employees

	Completed Years of Service												
Age	0	1	2	3 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40+	Totals
<25	223	103	20	15									361
25 to 29	176	138	66	71	12								463
30 to 34	133	120	74	74	73	11							485
35 to 39	137	142	124	121	93	47	7						671
40 to 44	144	137	116	140	118	52	34	7					748
45 to 49	105	84	76	126	152	72	34	29	3				681
50 to 54	77	58	67	105	113	89	58	19	10	1			597
55 to 59	73	74	47	89	106	122	98	47	30	7	1		694
60 to 64	55	59	46	72	84	78	70	66	40	9	6		585
65 to 69	39	45	25	38	54	28	28	29	16	4	1	2	309
70 and up	30	20	16	28	45	27	19	12	6			1	204
Totals	1,192	980	677	879	850	526	348	209	105	21	8	3	5,798

Teachers' Retirement System
State of Montana

Table C-2

Distribution of Inactive Lives

Members Receiving Service Retirement Benefits as of July 1, 2019

Age	Number of Persons	Annual Benefits in Thousands	Average Annual Benefits
<50	14	$ 393	$ 28,048
50 to 54	183	5,125	28,006
55 to 59	573	16,731	29,199
60 to 64	1,846	45,776	24,798
65 to 69	3,600	90,498	25,138
70 to 74	3,421	88,940	25,998
75 to 79	2,233	55,502	24,855
80 to 84	1,284	29,650	23,092
85 to 89	723	14,722	20,362
90 and up	364	5,430	14,918
Totals	14,241	$ 352,767	$ 24,771

Members Receiving Disability Retirement Benefits as of July 1, 2019

Age	Number of Persons	Annual Benefits in Thousands	Average Annual Benefits
<50	13	$ 173	$ 13,289
50 to 54	12	185	15,395
55 to 59	29	496	17,097
60 to 64	23	322	13,986
65 to 69	38	414	10,901
70 to 74	36	473	13,127
75 to 79	22	228	10,359
80 to 84	13	151	11,639
85 to 89	6	64	10,631
90 and up	7	57	8,214
Totals	199	$ 2,563	$ 12,876

Teachers' Retirement System
State of Montana

Table C-2

Distribution of Inactive Lives

Survivors of Deceased Retired Members as of July 1, 2019

Age	Number of Persons	Annual Benefits in Thousands	Average Annual Benefits
<50	87	$ 723	$ 8,308
50 to 54	26	222	8,547
55 to 59	33	476	14,414
60 to 64	71	1,007	14,179
65 to 69	137	2,246	16,394
70 to 74	197	3,820	19,389
75 to 79	245	5,046	20,595
80 to 84	223	4,302	19,290
85 to 89	170	2,638	15,519
90 and up	148	2,410	16,283
Totals	1,337	$ 22,890	$ 17,119

Survivors of Deceased Active Members as of July 1, 2019

Age	Number of Persons	Annual Benefits in Thousands	Average Annual Benefits
<50	103	$ 758	$ 7,364
50 to 54	21	244	11,636
55 to 59	36	319	8,859
60 to 64	54	554	10,258
65 to 69	85	1,258	14,797
70 to 74	59	709	12,013
75 to 79	47	682	14,511
80 to 84	29	320	11,035
85 to 89	18	221	12,296
90 and up	16	184	11,475
Totals	468	$ 5,249	$ 11,216

Teachers' Retirement System
State of Montana

Table C-2

Distribution of Inactive Lives

Terminated Vested Members as of July 1, 2019

Age	Number of Persons
<25	
25 to 29	11
30 to 34	101
35 to 39	204
40 to 44	220
45 to 49	253
50 to 54	300
55 to 59	403
60 to 64	202
65 to 69	81
70 and above	16
Total	1,791

Child Beneficiaries as of July 1, 2019

Age	Number of Persons
<5	
5 to 6	1
7 to 8	2
9 to 10	1
11 to 12	1
13 to 14	2
15 to 16	4
17 to 18	
Total	11

Teachers' Retirement System
State of Montana

Table C-3

Data Reconciliation

	Active Contributing Members*	Terminated Vested Members	Service Retired Members	Disabled Members	Survivors and Beneficiaries
July 1, 2018 Valuation	18,646	1,772	13,958	201	1,774
Refunds and Non-Vested Terminations	(1,230)	(49)			
Change to Annual Pay Under $1,000	(27)	8			
Vested Terminations	(223)	223			
Service Retirements	(536)	(77)	613		
Disability Retirements	(9)			9	
Deaths with Beneficiary	(10)	(3)	(100)	(4)	117
Deaths without Beneficiary			(220)	(7)	(74)
New Entrants	1,874				
Rehires	493	(75)	(12)		
Other	16	(8)	2		(1)
July 1, 2019 Valuation	18,994	1,791	14,241	199	1,816

* Excludes active members with annual compensation less than $1,000

Teachers' Retirement System
State of Montana

Appendix D

Comparative Schedules

This section contains tables that summarize the experience of the System shown in present and past valuation reports.

Table D-1 shows a summary of the active members covered as of the various valuation dates.

Table D-2 shows a summary of the retired and inactive members as of the various valuation dates.

Table D-3 summarizes the contribution rates determined by each annual actuarial valuation.

Teachers' Retirement System
State of Montana

Table D-1

Active Membership Data

Valuation Date (July 1)	Full-Time Members	Part-Time Members**	Total Contributing Members**	Part-Time Members Annual Compensation less than $1,000	Annual Full-Time Salaries in Thousands	Average Full-Time Annual Salary	Average Age**	Average Years of Service**	Average Hire Age**
2000	13,289	4,245	17,534	886	477,160	35,906	44.5	12.2	32.3
2002	12,796	4,650	17,446	723	486,204	37,997	45.0	12.2	32.8
2004	12,601	5,013	17,614	637	510,808	40,537	45.6	12.2	33.4
2005	12,523	5,019	17,542	697	523,909	41,836	45.8	12.4	33.4
2006	12,715	4,840	17,555	544	549,268	43,198	46.0	12.5	33.5
2007	12,634	4,994	17,628	548	568,351	44,986	46.2	12.5	33.7
2008	12,694	5,077	17,771	521	592,514	46,677	46.1	12.3	33.8
2009	12,673	5,270	17,943	513	613,077	48,377	46.2	12.4	33.8
2010	12,711	5,642	18,353	600	630,444	49,598	45.9	12.2	33.8
2011	12,506	5,400	17,906	578	633,005	50,616	46.2	12.4	33.8
2012	12,202	5,534	17,736	636	622,140	50,987	46.0	12.4	33.6
2013	12,229	5,387	17,616	633	628,832	51,421	45.8	12.2	33.6
2014	12,286	5,428	17,714	558	712,802	51,967	45.6	11.6	34.0
2015	12,468	5,337	17,805	511	729,653	52,551	45.4	11.3	34.1
2016	12,769	5,563	18,332	716	673,891	52,776	45.2	10.9	34.3
2017	12,808	5,576	18,384	533	689,638	53,844	45.0	10.8	34.2
2018	13,027	5,619	18,646	621	706,351	54,222	45.0	10.6	34.4
2019	13,196	5,798	18,994	692	728,831	54,231	44.9	10.4	34.5

* Not available.

** Excludes part-time active members with annual compensation less than $1,000.

Teachers' Retirement System
State of Montana

Table D-2

Retired and Inactive Membership Data

		All Annuitants					Terminated Members	
Valuation Date (July 1)	Number	Annual Benefits in Thousands	Average Annual Benefit	Average Current Age	Average Age at Retirement	Average Service at Retirement	Number Vested Terminated	Number Non-Vested Terminated
2000	9,021	117,227	12,995	69.3	57.0	*	1,256	9,308
2002	9,768	139,131	14,244	69.1	56.8	*	1,485	8,231
2004	10,375	159,776	15,400	69.1	56.7	*	1,620	7,861
2005	10,664	170,129	15,954	69.3	56.7	*	1,649	8,569
2006	11,019	181,114	16,436	69.3	56.5	*	1,684	8,542
2007	11,356	195,237	17,192	69.3	56.6	*	1,671	8,963
2008	11,788	208,985	17,729	69.4	56.7	*	1,649	9,574
2009	12,036	219,267	18,218	69.7	57.5	25.5	1,640	9,868
2010	12,440	234,048	18,814	69.9	57.6	25.5	1,553	10,304
2011	12,899	250,500	19,420	70.0	57.8	25.5	1,580	10,727
2012	13,363	267,851	20,044	70.2	57.9	25.5	1,566	11,172
2013	13,868	284,333	20,503	70.4	58.0	25.5	1,566	11,710
2014	14,349	302,272	21,066	70.6	58.2	25.5	1,654	12,308
2015	14,839	321,511	21,667	70.9	58.3	25.4	1,664	12,839
2016	15,164	336,465	22,188	71.1	58.5	25.4	1,704	12,888
2017	15,566	352,005	22,614	71.4	58.6	25.3	1,779	13,712
2018	15,933	367,990	23,096	71.6	58.7	25.3	1,772	13,967
2019	16,256	383,495	23,591	72.0	58.9	25.2	1,791	14,261

* Not available.

Teachers' Retirement System
State of Montana

Table D-3

Contribution Rates

Valuation Date	Contribution Rates			Normal	UAAL
(July 1)	Employee	Employer	Total	Cost Rate[1]	Rate[2]
2002	7.15	7.58[3]	14.73	10.33	4.40
2004	7.15	7.58	14.73	10.34	4.39
2005	7.15	7.58	14.73	10.35	4.38
2006	7.15	7.58	14.73	10.37	4.36
2007	7.15	9.58	16.73	10.40	6.33
2008	7.15	9.58	16.73	10.87	5.86
2009	7.15	9.96	17.11	10.69	6.42
2010	7.15	9.96	17.11	9.74	7.37
2011	7.15	9.96	17.11	9.64	7.47
2012	7.15	9.96	17.11	9.64	7.47
2013	8.15	10.96	19.11	9.20	9.91
2014	8.15	11.06	19.21	9.44	9.77
2015	8.15	11.16	19.31	9.49	9.82
2016	8.15	11.26	19.41	10.18	9.23
2017	8.15	11.36	19.51	10.15	9.36
2018	8.15	11.46	19.61	10.32	9.29
2019	8.15	11.56	19.71	10.14	9.57

1 Effective July 1, 2014, the Normal Cost Rate includes the administrative expense load.
2 The UAAL rate is the amount available to amortize the UAAL. It is equal to the total contribution rate, minus the normal cost rate.
3 The 1999 Legislation which passed the 1.5% GABA, also added a 0.11% state general fund contribution.

Teachers' Retirement System
State of Montana

Appendix E

Glossary

The following definitions are largely excerpts from a list adopted in 1981 by the major actuarial organizations in the United States. In some cases the definitions have been modified for specific applicability to the Montana Teachers' Retirement System. Defined terms are capitalized throughout this Appendix.

Accrued Benefit

The amount of an individual's benefit (whether or not vested) as of a specific date, determined in accordance with the terms of a pension plan and based on compensation and service to that date.

Actuarial Accrued Liability

That portion, as determined by a particular Actuarial Cost Method, of the Actuarial Present Value of pension plan benefits and expenses which is not provided for by future Normal Costs.

Actuarial Assumptions

Assumptions as to the occurrence of future events affecting pension costs, such as: mortality, withdrawal, disablement, and retirement; changes in compensation, rates of investment earnings, and asset appreciation or depreciation; procedures used to determine the Actuarial Value of Assets; and other relevant items.

Actuarial Cost Method

A procedure for determining the Actuarial Present Value of pension plan benefits and expenses and for developing an actuarially equivalent allocation of such value to time periods, usually in the form of a Normal Cost and an Actuarial Accrued Liability.

Actuarial Gain (Loss)

A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions during the period between two Actuarial Valuation dates, as determined in accordance with a particular Actuarial Cost Method.

Actuarial Present Value

The value of an amount or series of amounts payable or receivable at various times, determined as of a given date by the application of a particular set of Actuarial Assumptions.

Actuarial Valuation

The determination, as of a valuation date, of the Normal Cost, Actuarial Accrued Liability, Actuarial Value of Assets, and related Actuarial Present Values for a pension plan.

Actuarial Value of Assets

The value of cash, investments and other property belonging to a pension plan, as used by the actuary for the purpose of an Actuarial Valuation.

Actuarially Equivalent

Of equal Actuarial Present Value, determined as of a given date with each value based on the same set of Actuarial Assumptions.

Amortization Payment

That portion of the pension plan contribution which is designed to pay interest on and to amortize the Unfunded Actuarial Accrued Liability.

Entry Age Actuarial Cost Method

A method under which the Actuarial Present Value of the Projected Benefits of each individual included in an Actuarial Valuation is allocated on a level basis over the earnings of the individual between entry age and assumed exit ages. The portion of this Actuarial Present Value allocated to a valuation year is called the Normal Cost. The portion of this Actuarial Present Value not provided for at a valuation date by the Actuarial Present Value of future Normal Costs is called the Actuarial Accrued Liability.

Market Value of Assets

The fair value of cash, investments and other property belonging to a pension plan that could be acquired by exchanging them on the open market.

Normal Cost

That portion of the Actuarial Present Value of pension plan benefits and expenses which is allocated to a valuation year by the Actuarial Cost Method.

Projected Benefits

Those pension plan benefit amounts which are expected to be paid at various future times under a particular set of Actuarial Assumptions, taking into account such items as the effect of advancement in age and past and anticipated future compensation and service credits.

Unaccrued Benefit

The excess of an individual's Projected Benefits over the Accrued Benefits as of a specified date.

Unfunded Actuarial Accrued Liability

The excess of the Actuarial Accrued Liability over the Actuarial Value of Assets.